IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellants	:	Jerry Alten et al.
Application No.	:	09/410,853 Confirmation No. : 7565
Filed	:	October 1, 1999
For	:	IMPROVED ELECTRONIC TELEVISION PROGRAM GUIDE SCHEDULE SYSTEM AND METHOD
Group Art Unit	:	2623
Examiner	:	Annan Q. Shang

New York, New York 10036
May 5, 2008

Mail Stop Appeal Briefs - Patent
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

APPEAL BRIEF UNDER 37 C.F.R. § 41.37

Sir:

Appellants are filing this Appeal Brief in support of their appeal from the final rejection of claims 1, 2, 4-7, 13-15, 17-20, 26-28, 30-33, 39-45, 47 and 52-59 in the final Office Action dated August 9, 2007 ("Final Office Action"). A Notice of Appeal for this case was filed on December 5, 2007.

In view of the arguments and authorities set forth below, the Board should find the rejection of claims 1, 2, 4-7, 13-15, 17-20, 26-28, 30-33, 39-45, 47 and 52-59 to be in error, and the Board should reverse the rejection.

(i) Real Party in Interest

Appellants respectfully advise the Board that the real party in interest in the above-identified patent application is United Video Properties, Inc., a corporation organized and existing under the laws of the State of Delaware, and having an office and place of business at 6922 Hollywood Boulevard, Los Angeles, CA 90028, which is the assignee of this application.

(ii) Related Appeals and Interferences

Appellants respectfully advise the Board that there are no other appeals or interferences known to appellants, their legal representative, or their assignee that will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(iii) Status of Claims

Claims 3, 8-12, 16, 21-25, 29, 34-38, 46 and 48-51 have been canceled. Claims 1, 2, 4-7, 13-15, 17-20, 26-28, 30-33, 39-45, 47 and 52-59 are finally rejected in this application and are on appeal.

Claims 1, 2, 4-7, 13-15, 17-20, 26-28, 30-33, 39-45, 47 and 52-59 are pending in this application.

(iv) Status of Amendments

Appellants have not submitted any amendments pursuant to 37 C.F.R. § 1.116 or in reply to the Final Office Action, from which this appeal is being sought.

(v) Summary of Claimed Subject Matter

Appellants' independent claims 1, 14, 27, and 40 relates to a method, systems, and machine-readable media for providing help information that explains to a user how an electronic television program guide operates. *See, e.g.,* specification, page 21, lines 14-28. The current operating mode of the electronic television program guide is tracked and stored as the user operates the guide. *See, e.g.,* specification, page 21, line 34-page 22, line 3. A user input is received and in response to the user input, the help information that explains how the electronic program guide operates is provided. *See, e.g.,* specification, page 22, lines 3-6. The help information that is provided is based on the stored current operating mode of the guide. *See, e.g.,* specification, page 22, lines 3-6.

(vi) Ground of Rejection to be Reviewed on Appeal

The grounds of rejection to be reviewed on this appeal are the final rejection of claims 1, 4-5, 13-14, 17-18, 26-27, 30-31, 39-40, 42-43, 47 and 52-59 under 35 U.S.C. § 103(a) as being unpatentable over Young in view of Richards, and the final

rejection of claims 2, 6-7, 15, 19-20, 28, 32-33, 41, and 44-45 under 35 U.S.C. § 103(a) as being unpatentable over Young in view of Richards, and further in view of Palmer.

(vii) Argument

A. The requirements for a *prima facie* obviousness rejection have not been met

To establish *prima facie* obviousness, all of the claim limitations must be taught or suggested by the prior art. *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). "All words in a claim must be considered in judging the patentability of that claim against the prior art."

In the rejection of claims 1, 14, 22 and 40 over Young in view of Richards, the Examiner concedes that Young fails to teach appellants' claimed feature of "tracking and storing a current operating mode of the electronic program guide as the user operates the electronic television program guide," and providing help information based on the stored current operating mode (Office Action, page 6). The Examiner then attempts to find this claim feature in Richards.

Contrary to the Examiner's contention, however, Richards also fails to teach this feature of appellants' claims.

B. The combination of Young and Richards does not disclose "tracking and storing a current operating mode ... of the guide as the user operates"

The Examiner contends that Richards discloses tracking and storing a current operation mode as the user operates the electronic program guide.

As an initial matter, the Examiner cites almost three quarters of the specification, excluding the programming specifications ("figs. 1-4, col. 1, l. 61-col. 2, l. 61, col. 3, l. 1-col. 4, l. 33, col. 5, ll. 8-25, l. 46-col. 6, l. 9, col. 7, l. 7-47 and 47-col. 8, l. 1+," see Office Action, p. 6) without specifically pointing to disclosure showing how the Richards system tracks and stores an operating mode as the user operates the guide. Appellants have scoured the reference and have too failed to identify any disclosure suggesting that Richards operates as required by appellants' claims.

In fact, Richards does not operate as contended by the Examiner. Contrary to appellants' claimed approach, in which the guide tracks and stores the operating mode to provide immediate access to contextual help information, the Richards system does not always know the current mode of the system. Instead, the Richards system provides three different levels of help by determining current system variables upon receiving a help request, and providing help associated with the determined system variables.

First level help is provided in response to the user pressing the Help key once (col. 7, ll. 25-26). In response to the user interaction, a help message that relates to the box or panel located under the pointer is provided (col. 7, ll. 26-29). Unlike other levels of help, the first level help is "provided by the application concerned" (col. 7, ll. 34-35) without first identifying or setting system variables (e.g., col. 8, ll. 55-62). Thus, because the application providing the first level help does not identify or set system variables, it cannot track and store a current operating mode of the system -- the application cannot inherently know, much less track and store the overall system variables without being told by the system. Accordingly, the first level help provided by Richards does not operate by tracking and storing a current operating mode of the system as the user operates the system.

Second level help is provided when the user presses the Help key twice (col. 7, ll. 36-40). In response to detecting that the Help key was pressed twice, the application requesting help calls a Help application and moves to its QUEUE block, which sets system variables (i.e., S.Help.Facility, S.Help.Application, S.Help.Panel and S.Help.Box) (col. 8, ll.59-63, cols. 45-46, ll. 13-17). To set the system variables, the QUEUE block calls a DETSUBJECT procedure, used to determine the

subject for which help is provided (cols. 45-46, l. 19). The DETSUBJECT procedure examines the appropriate variables for data passed from the QUEUE block, and sets the "variables 'FacName,' 'AppName,' 'PanName,' and 'BoxName'" to the facility, application, panel and box for which help has been requested (cols. 21-22, ll. 6-11, ll. 17-21). The QUEUE block then identifies and displays help information based on the set variables using a SETPOINTERS procedure that "determines the name of the datastore in which Help for the required subject will be found, and sets up pointers to the columns in the help index and the help text tables in the datastore" (cols 35-36, l. 29-cols. 37-38, l. 2).

Thus, second level help is provided by determining, in response to receiving the request for second level help and only at the time the request is received, the facility, application, panel and box of the application for which help is requested. Accordingly, the Richards system does not track and store an operating mode as the user operates the system to provide second level help, but rather identifies, upon request, system variables used for providing the help based on the known current facility, application, panel and box for which help was requested.

Third level help is provided in response to a user selecting a "Tutorial" box in the help window, after having first viewed second level help (col. 7, ll. 63-65). In response to selecting the "Tutorial" box (e.g., identified by the SELECT block of the Help application, cols. 49-50, ll. 14-22), the TUTSELECT procedure is called. The TUTSELECT procedure sets up the variables used to pass the subject for the tutorial and starts the HelpTut task, which provides a tutorial for the user on the specified subject (cols. 19-20, ll. 11-15; cols. 41-42, ll. 7-12). Thus the third level help uses the context of the second level help to provide the appropriate tutorial. Accordingly, third level help is not provided in response to tracking and storing a current operation mode as the user operates the system, as required by appellants' claims, but rather provided by identifying, upon request to access third level help, the appropriate system variables.

In view of the foregoing, Richards and Young, whether taken alone or in combination, fail to show or suggest "tracking and storing the current operating mode of an electronic television program guide as a user operates the guide" and "providing help information based on the stored current operating mode," as required by appellants independent claims 1, 14, 27, and 40. Accordingly, appellants respectfully submit

that the Examiner has not established *prima facie* obviousness, because the prior art references, when combined, fail to teach or suggest all of the claim limitations (MPEP § 2143).

C. The dependent claims are patentable for at least the reasons that the independent claims are patentable

If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Accordingly, appellants submit that dependent claims 2, 4-7, 13, 15, 17-20, 26, 28, 30-33, 39, and 41-45, 47, and 52-59 are found allowable over Young, Richards and Palmer, whether taken alone or in combination, for at least the reasons that independent claims 1, 14, 27 and 40 are patentable over Young and Richards, whether taken alone or in combination.

D. Conclusion

For the foregoing reasons, appellants submit that Young and Richards, whether taken alone or in combination, do not render unpatentable any of appellants' claims 1, 4-5, 13-14, 17-18, 26-27, 30-31, 39-40, 42-43, 47 and 52-59. Appellants further submit that Young, Richards and Palmer, whether taken alone or in combination, do not render unpatentable any of appellants' claims 2, 6-7, 15, 19-20, 28, 32-33, 41, and 44-45.

The Final Office Action's rejections of these claims under 35 U.S.C. § 103(a) should therefore be reversed.

This Brief has the following appendices:

(viii) Claims Appendix

Appendix A: Copy of claims 1, 2, 4-7, 13-15, 17-20, 26-28, 30-33, 39-45, 47 and 52-59 involved in this appeal;

(ix) Evidence Appendices

Appendix B: Copy of the final Office Action dated August 9, 2007;

Appendix C: Copy of Young et al. U.S. Patent No. 4,706,121 ("Young");

Appendix D Copy of Richards et al. U.S. Patent No. 5,179,654 ("Richards"); and

Appendix E Copy of Palmer et al. U.S. Patent No. 6,320,588 ("Palmer").

(x) Related Proceedings Appendix

None.

III. Conclusion

In view of the foregoing, claims 1, 2, 4-7, 13-15, 17-

20, 26-28, 30-33, 39-45, 47, and 52-59 are in condition for allowance. This application is therefore in condition for allowance. Reconsideration and allowance of the application are respectfully requested.

Respectfully submitted,

/Paul E. Leblond/

Paul E. Leblond
Registration No. 58,397
Agent for Appellants
Ropes & Gray LLP
Customer No. 75563
1211 Avenue of the Americas
New York, New York 10036
Tel.: (212) 596-9000

APPENDIX A: Listing of claims involved in the appeal

Listings of Claims:

1. (Previously presented) A method for providing help information that explains to a user of an electronic television program guide how the electronic television program guide operates, the method comprising:

tracking and storing a current operating mode of the electronic program guide as the user operates the electronic television program guide, wherein the electronic television program guide has a plurality of operating modes;

receiving a user input; and

providing help information that explains to the user how the electronic television program guide operates in response to receiving the user input, wherein the help information provided is based on the stored current operating mode.

2. (Previously presented) The method defined in claim 1 further comprising:

displaying a help icon using the electronic television program guide, wherein receiving the user input comprises receiving a user selection of the help icon.

3. (Canceled)

4. (Previously presented) The method defined in claim 1 wherein providing help information comprises displaying the help information in response to the user input, wherein a user depressing a help key on a remote control generates the user input.

5. (Previously presented) The method defined in claim 1 wherein providing help information comprises displaying a text message that explains to the user how a portion of the electronic television program guide operates.

6. (Previously presented) The method defined in claim 1 wherein providing help information comprises displaying an instructional video that explains to the user how a portion of the electronic television program guide operates.

7. (Previously presented) The method defined in claim 1 wherein providing help information comprises playing an instructional audio program that explains to the user how a portion of the electronic television program guide operates.

8-12. (Canceled)

13. (Previously presented) The method defined in claim 1 further comprising:

storing the help information in a memory; and

retrieving the help information from the memory in response to receiving the user input.

14. (Previously presented) An electronic television program guide system that provides help information for explaining to a user of an electronic television program guide how the electronic television program guide operates, the system comprising:

means for tracking and storing a current operating mode of the electronic program guide as the user operates the electronic television program guide, wherein the electronic television program guide has a plurality of operating modes;

means for receiving a user input; and

means for providing help information that explains to the user how the electronic television program guide operates in response to receiving the user input, wherein the help information provided is based on the stored current operating mode.

15. (Previously presented) The system defined in claim 14 further comprising:

means for displaying a help icon using the electronic television program guide wherein receiving the user input comprises receiving a user selection of the help icon.

16. (Canceled)

17. (Previously presented) The system defined in claim 14 wherein the means for providing help information comprises means for displaying the help information in response to the user input, wherein a user depressing a help key on a remote control generates the user input.

18. (Previously presented) The system defined in claim 14 wherein the means for providing help information comprises means for displaying a text message that explains to the user how a portion of the electronic television program guide operates.

19. (Previously presented) The system defined in claim 14 wherein the means for providing help information comprises means for displaying an instructional video that

explains to the user how a portion of the electronic television program guide operates.

20. (Previously presented) The system defined in claim 14 wherein the means for providing help information comprises means for playing an instructional audio program that explains to the user how a portion of the electronic television program guide operates.

21-25. (Canceled)

26. (Previously presented) The system defined in claim 14 further comprising:

means for storing the help information; and

means for retrieving the help information from the means for storing in response to receiving the user input.

27. (Previously presented) An electronic television program guide system that provides help information for explaining to a user of an electronic television program guide how the electronic television program guide operates, the system comprising:

a video display generator;

a remote controller;

a microcontroller; and

an electronic television program guide executed by the microcontroller and programmed to (1) track and store a current operating mode of the electronic program guide as the user operates the electronic television program guide, wherein the electronic television program guide has a plurality of operating modes, (2) receive a user input and (3) provide help information that explains to the user how the electronic television program guide operates to the video display generator for display in response to receiving the user input, wherein the help information provided is based on the stored current operating mode.

28. (Previously presented) The system defined in claim 27 wherein the electronic television program guide is further programmed to:

provide a help icon to the video display generator for display; and

provide the user with an opportunity to select the help icon using the remote controller.

29. (Canceled)

30. (Previously presented) The system defined in claim 27 wherein:

the remote controller comprises a help key; and

the electronic television program guide is further configured to provide the help information to the video display generator in response to the user depressing the help key on the remote controller.

31. (Previously presented) The system defined in claim 27 wherein:

the help information comprises a text message that explains to the user how a portion of the electronic television program guide operates; and

the electronic television program guide is further programmed to provide the text message to the video display generator for display.

32. (Previously presented) The system defined in claim 27 wherein:

the help information comprises an instructional video that explains to the user how a portion of the electronic television program guide operates; and

the electronic television program guide is further configured to provide the instructional video to the video display generator for display.

33. (Previously presented) The system defined in claim 27 wherein:

the system further comprises a television;

the help information comprises an instructional audio program that explains to the user how a portion of the electronic television program guide operates; and

the electronic television program guide is configured to provide the audio program to the video display generator for playback by the television.

34-38. (Canceled)

39. (Previously presented) The system defined in claim 27 wherein the electronic television program guide is further programmed to:

store the help information in a memory; and

retrieve the help information from the memory in response to receiving the user input.

40. (Previously presented) Machine-readable media for use with an electronic television program guide, the machine-readable media comprising program logic recorded thereon for:

tracking and storing a current operating mode of the electronic program guide as the user operates the electronic television program guide, wherein the electronic television program guide has a plurality of operating modes;

receiving a user input; and

providing help information that explains to the user how the electronic television program guide operates in response to receiving the user input, wherein the help information provided is based on the stored current operating mode.

41. (Previously presented) The machine-readable media defined in claim 40 further comprising program logic recorded thereon for displaying a help icon using the electronic television program guide wherein receiving the user input comprises receiving a user selection of the help icon.

42. (Previously presented) The machine-readable media defined in claim 40 wherein the program logic for providing help information comprises program logic for

displaying the help information in response to the user input, wherein a user depressing a help key on a remote control generates the user input.

43. (Previously presented) The machine-readable media defined in claim 40 wherein the program logic for providing help information comprises program logic for displaying a text message that explains to the user how a portion of the electronic television program guide operates.

44. (Previously presented) The machine-readable media defined in claim 40 wherein the program logic for providing help information comprises program logic for displaying an instructional video that explains to the user how a portion of the electronic television program guide operates.

45. (Previously presented) The machine-readable media defined in claim 40 wherein the program logic for providing help information comprises program logic for playing an instructional audio program that explains to the user how a portion of the electronic television program guide operates.

46. (Canceled)

47. (Previously presented) The machine-readable media defined in claim 40 further comprising program logic recorded thereon for:

storing the help information in a memory; and

retrieving the help information from the memory in response to receiving the user input.

48-51. (Canceled).

52. (Previously presented) The method defined in claim 1 wherein the current operating mode is one of flip, browse, menu, impulse ordering, and setting a lockout.

53. (Previously presented) The system defined in claim 14 wherein the current operating mode is one of flip, browse, menu, impulse ordering, and setting a lockout.

54. (Previously presented) The system defined in claim 27 wherein the current operating mode is one of flip, browse, menu, impulse ordering, and setting a lockout.

55. (Previously presented) The machine-readable media defined in claim 40 wherein the current operating mode is

one of flip, browse, menu, impulse ordering, and setting a lockout.

56. (Previously presented) The method defined in claim 1 wherein the stored current operating mode of the electronic television program guide comprises data reflecting the current operating mode.

57. (Previously presented) The system defined in claim 14 wherein the stored current operating mode of the electronic television program guide comprises data reflecting the current operating mode.

58. (Previously presented) The system defined in claim 27 wherein the stored current operating mode of the electronic television program guide comprises data reflecting the current operating mode.

59. (Previously presented) The machine-readable media defined in claim 40 wherein the stored current operating mode of the electronic television program guide comprises data reflecting the current operating mode.

APPENDIX B: Copy of the Final Office Action dated August 9, 2007

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/410,853	10/01/1999	JERRY ALTEN	UV-137-CONT.	7565

7590 08/09/2007

Joseph M Guiliano
Fish & Neave IP Group Roper & Gray LL
1251 Avenue of the Americas
New York, NY 10020

RECEIVED

AUG 14 2007

PATENT
REFERRED TO PC2
NOTED BY

EXAMINER	
SHANG, ANNAN Q	
ART UNIT	PAPER NUMBER
2623	

MAIL DATE	DELIVERY MODE
08/09/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

File No.: UV/137 Cont 2
Action Desc: 3 Month Ext. of Time
Due Date: Nov 9, 2007
By

File No.: UV/137 CON
Action Desc: Notice of Appeal
Due Date: Feb 9, 2008
By

Office Action Summary	Application No.	Applicant(s)	
	09/410,853	ALTEN ET AL.	
	Examiner	Art Unit	
	Annan Q. Shang	2623	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 June 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4-7,13-20,26-33,39-45,47 and 52-59* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,4-7,13-20,26-33,39-45,47 and 52-59* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments with respect to claims 1, 2, 4-7, 13-15, 17-20, 26-28, 30-33, 39-45, 47 and 52-59 have been considered but are moot in view of the new ground(s) of rejection.

With respect to claims 1, 4-5, 13-14, 17-18, 2, 26-27, 30-31, 39-40, 42-43 and 46-47, are rejected under 35 U.S.C. 103(a) as being unpatentable over **Young et al (4,706,121)** in view of **Richards et al (5,179,654),** and claims 2, 6-7, 15, 19-20, 28, 32-33, 41 and 44-45 rejected under 35 U.S.C. 103(a) as being unpatentable over **Young** in view of **Richards**, and further in view of **Palmer et al (6,320,588)**, applicant recites the claimed invention and the prior arts of record and further argues that the prior arts of record do not teach claims limitations, i.e., "...tracking and storing the current operating mode of the electronic program guide as the user operates the television program guide...and where the help information provided is based on the stored current operating mode..." and further argues that the combination is not proper and that Examiner has not established a *prima facie* case of obviousness (see page 6+ of Applicant's Remarks).

In response, Examiner disagrees. Examiner notes applicant's argument, however the amended claims do not overcome the prior arts of records. Young teaches receiving a user input, via Remote Receiver (RR) 118 or 190 receives via Remote Control Transmitters (RC) 116 or 118, where a user selects a key PG 224 "help information key" on RC 116 or 118 to receive help information for the television program

guide 'EPG' or television Menu (col. 9, line 54 and col. 12, lines 30-44) that explains to the user how the electronic television program guide operates, displaying the help information at the bottom of the screen of Television Receiver (TV) 126 or 200. Young fails to explicitly teach tracking and storing a current operating mode of the electronic program guide as the user operates the electronic television program guide and providing help information based on the stored current operating mode, however this deficiency in Young is disclosed in Richard's reference, which teaches a menu system which provides help information, that appear through pop-up windows, at various operating mode of the menu, where a user navigates through menus and Microprocessor 10, tracks and stores the current operating mode of the menu as the user operates the menu and provides help information based on the stored current operating mode of the menu (see col.1, line 61-col.2, line 61, col.3, line 1-col.4, line 33 and figs. 1-4, col.5, lines 8-25, line 46-col.6, line 9, col.7, lines 7-47 and line 47-col.8, line 1+). Furthermore figures 5-8, illustrates a display menu where a user via an input device interacts with the displayed menu or listing and upon request receives help information at the specific location or current state of the point in the menu, concurrently with the information related to the task(s).

With respect to Applicant arguments as to obviousness, Examiner, maintains that, the test for obviousness is not whether the features of a secondary reference may be bodily incorporate into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all the references. Rather, the test is what the combined teachings of the references would have suggested to

those of ordinary skill in the art. In this case Young teaches where a user via Remote Control Transmitters (RC) 116 or 118, selects a key PG 224 "help information key" to receive help information for the television program guide 'EPG' or television Menu, that explains to the user how the electronic television program guide operates, displaying the help information at the bottom of the screen of Television Receiver (TV) 126 or 200. Young silent to explicitly teach tracking and storing a current operating mode of the electronic program guide as the user operates the electronic television program guide and providing help information based on the stored current operating mode, however in the same field of endeavor, i.e., a display System for processing and displaying electronic menu, listing, guide, etc., this deficiency in Young is disclosed in Richard's reference, which teaches a menu system which provides help information, that appear through pop-up windows, at various operating mode of the menu, where a user navigates through menus, where a Microprocessor 10, tracks and stores the current operating mode of the menu as the user operates the menu and provides help information based on the stored current operating mode of the menu, as such combining the teaching of Young and Richards would be within the knowledge of one of ordinary skill in the art, and appropriate motivation was given as discussed below in the office action.

Furthermore it appears Applicant's arguments are directed against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. **See *In re***

the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. In this case

Young teaches where a user via Remote Control Transmitters (RC) 116 or 118, selects a key PG 224 "help information key" to receive help information for the television program guide 'EPG' or television Menu, that explains to the user how the electronic television program guide operates, displaying the help information at the bottom of the screen of Television Receiver (TV) 126 or 200. Young silent to explicitly teach tracking and storing a current operating mode of the electronic program guide as the user operates the electronic television program guide and providing help information based on the stored current operating mode, however in the same field of endeavor, i.e., a display System for processing and displaying electronic menu, listing, guide, etc., this deficiency in Young is disclosed in Richard's reference, which teaches a menu system which provides help information, that appear through pop-up windows, at various operating mode of the menu, where a user navigates through menus, where a Microprocessor 10, tracks and stores the current operating mode of the menu as the user operates the menu and provides help information based on the stored current operating mode of the menu, as such combining the teaching of Young and Richards would be within the knowledge of one of ordinary skill in the art, and appropriate motivation was given as discussed below in the office action.

Furthermore it appears Applicant's arguments are directed against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. **See *In re***

***Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).**

In view of the above, the combination of Young and Richards is proper and maintained as repeated below. **This Office Action is made FINAL.**

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 4, 5, 13, 14, 17, 18, 26, 27, 30, 31, 39, 40, 42, 43, 46 and 47 and 52-59 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Young et al (4,706,121)** in view of **Richards et al (5,179,654).**

As to claim 1, note the **Young** reference figures 1-3, discloses a TV schedule or EPG system and process which allows a user selection of broadcast programs from schedule information and further discloses a method for providing help information that explains to a user of an electronic television program guide how the electronic television program guide operates, the method comprises the following:

the claimed "receiving a user input and providing help information that explains to the user how the electronic television program guide operates..." is met by Remote Receiver (RR) 118 or 190 (figs. 3-5, col. 7, lines 33-57 and col. 9, line 48-col. 10, line 10), note that RR 118 or 190 receives via Remote Control Transmitters (RC) 116 or

118, user inputs where if the user selects key PG 224 "help information key" on RC 116, or 118, help information (col. 9, line 54 and col. 12, lines 30-44) that explains to the user how the electronic television program guide (EPG) operates is displayed at the bottom of the screen of Television Receiver (TV) 126 or 200.

Young fails to explicitly teach tracking and storing a current operating mode of the electronic program guide as the user operates the electronic program guide and providing help information based on the stored current operating mode.

However, **Richards** teaches a menu system which provides help information, that appear through pop-up windows, at various operating mode of the menu and the system tracks and stores the current operating mode of the menu as the user operates the menu and provides help information based on the stored current operating mode of the menu and where the stored current operating mode of the menu comprises data reflecting the current operating mode (figs. 1-4, col.1, line 61-col.2, line 61, col.3, line 1-col.4, line 33, col.5, lines 8-25, line 46-col.6, line 9, col.7, lines 7-47 and line 47-col.8, line 1+), note that the user navigates through menus and Microprocessor 10, tracks and stores each menu and also items within each menu to dynamically provide different levels of help information based on the mode of operation of a menu.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teaching of Richards into the system of Young to dynamically generate help text or instruction and display help text on each selected tile, item or grid of the EPG data, and furthermore enable interaction with each selected tiles

or grid of the EPG data for additional information, help or instructions relating to the selected tile or grid of the EPG data.

As to claim 4, Young further discloses where RC 116 or 118 generates the user input in response to the user depressing PG 224 "help information key" on RC 116 or 118 (col. 9, line 54 and col. 12, lines 30-44), to displayed help information at the bottom of the screen of TV 126 or 200.

As to claim 5, Young further discloses displaying a text message (col. 12, lines 30-58), which explains to the user how a portion of the EPG operates.

As to claim 13, Young further discloses storing the help information in memory and retrieving the help information from the memory in response to receiving the user input (col. 7, lines 47-64, col. 8, lines 32-44 and col. 12, lines 64-68).

As to claim 14, note the **Young** reference figures 1-3, discloses a TV schedule system and process which allows a user selection of broadcast programs from schedule information and further discloses a method for providing help information that explains to a user of an electronic television program guide how the electronic television program guide operates, the system comprises the following:

the claimed "means for receiving a user input and means for providing help information that explains to the user how the electronic television program guide operates..." is met by Remote Receiver (RR) 118 or 190 (figs. 3-5, col. 7, lines 33-57 and col. 9, line 48-col. 10, line 10), note that RR 118 or 190 receives via Remote Control Transmitters (RC) 116 or 118, user inputs, where if the user selects key PG 224 "help information key" on RC 116 or 118, help information (col. 9, line 54 and col. 12,

lines 30-44), that explains to the user how the electronic television program guide operates is displayed at the bottom of the screen of Television Receiver (TV) 126 or 200.

Young fails to explicitly teach tracking and storing a current operating mode of the electronic program guide as the user operates the electronic program guide and providing help information based on the stored current operating mode.

However, **Richards** teaches a menu system which provides help information, that appear through pop-up windows, at various operating mode of the menu and the system tracks and stores the current operating mode of the menu as the user operates the menu and provides help information based on the stored current operating mode of the menu and where the stored current operating mode of the menu comprises data reflecting the current operating mode (figs. 1-4, col.1, line 61-col.2, line 61, col.3, line 1-col.4, line 33, col.5, lines 8-25, line 46-col.6, line 9, col.7, lines 7-47 and line 47-col.8, line 1+), note that the user navigates through menus and Microprocessor 10, tracks and stores each menu and also items within each menu to dynamically provide different levels of help information based on the mode of operation of a menu.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teaching of Richards into the system of Young to dynamically generate help text or instruction and display help text on each selected tile, item or grid of the EPG data, and furthermore enable interaction with each selected tiles or grid of the EPG data for additional information, help or instructions relating to the selected tile or grid of the EPG data.

Claim 17, is met as previously discussed with respect claim 4.

Claim 18, is met as previously discussed with respect claim 5.

Claim 26, is met as previously discussed with respect claim 13.

As to claim 27, note the **Young** reference figures 1-3, discloses a TV schedule system and process which allows a user selection of broadcast programs from schedule information and further discloses an electronic television program guide system that provides help information for explaining to a user of an electronic television program guide how the electronic television program guide operates, the system comprises the following:

the claimed "a video display generator," is met by Video Display Generator (VDG) 204 (col. 8, lines 48-62);

the claimed "a remote controller," is met by Remote Control Transmitters (RC) 116 or 118 (col. 7, lines 33-57 and col. 9, lines 48-52);

the claimed "a microcontroller," is met by CPU 178 (col. 8, lines 35-62); and electronic television program guide (EPG) executed by CPU 178 and programmed to receiver a user input via Remote Control Transmitters (RC) 116 or 118 and Remote Receiver (RR) 118 or 190 (figs. 3-5, col. 7, lines 33-57 and col. 9, line 48-col. 10, line 10), and provides help information at the bottom of the screen of Television Receiver (TV) 126 or 200 that explains to the user how the EPG operates to the VDG 204 in response to receiving the user input, i.e., when the user presses PG 224 "help information key" on RC 166 or 118.

Young fails to explicitly teach tracking and storing a current operating mode of the electronic program guide as the user operates the electronic program guide and providing help information based on the stored current operating mode.

However, **Richards** teaches a menu system which provides help information, that appear through pop-up windows, at various operating mode of the menu and the system tracks and stores the current operating mode of the menu as the user operates the menu and provides help information based on the stored current operating mode of the menu and where the stored current operating mode of the menu comprises data reflecting the current operating mode (figs. 1-4, col.1, line 61-col.2, line 61, col.3, line 1-col.4, line 33, col.5, lines 8-25, line 46-col.6, line 9, col.7, lines 7-47 and line 47-col.8, line 1+), note that the user navigates through menus and Microprocessor 10, tracks and stores each menu and also items within each menu to dynamically provide different levels of help information based on the mode of operation of a menu.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teaching of Richards into the system of Young to dynamically generate help text or instruction and display help text on each selected tile, item or grid of the EPG data, and furthermore enable interaction with each selected tiles or grid of the EPG data for additional information, help or instructions relating to the selected tile or grid of the EPG data.

Claim 30, is met as previously discussed with respect claim 4.

Claim 31, is met as previously discussed with respect claim 5.

Claim 39, is met as previously discussed with respect claim 13.

As to claim 40, note the **Young** reference figures 1-3, discloses a TV schedule system and process which allows a user selection of broadcast programs from schedule information and further discloses machine-readable media for use with an electronic television program guide, the machine-readable media comprising program logic recorded there for the following:

the claimed "receiving a user input and providing help information that explains to the user how the electronic television program guide operates..." is met by Remote Receiver (RR) 118 or 190 (figs. 3-5, col. 7, lines 33-57 and col. 9, line 48-col. 10, line 10), note that RR 118 or 190 receives via Remote Control Transmitters (RC) 116 or 118, user inputs where if the user selects key PG 224 "help information key" on RC 116 or 118, help information (col. 9, line 54 and col. 12, lines 30-44) that explains to the user how the electronic television program guide operates is displayed at the bottom of the screen of Television Receiver (TV) 126 or 200.

Young fails to explicitly teach tracking and storing a current operating mode of the electronic program guide as the user operates the electronic program guide and providing help information based on the stored current operating mode.

However, **Richards** teaches a menu system which provides help information, that appear through pop-up windows, at various operating mode of the menu and the system tracks and stores the current operating mode of the menu as the user operates the menu and provides help information based on the stored current operating mode of the menu and where the stored current operating mode of the menu comprises data reflecting the current operating mode (figs. 1-4, col.1, line 61-col.2, line 61, col.3, line 1-

col.4, line 33, col.5, lines 8-25, line 46-col.6, line 9, col.7, lines 7-47 and line 47-col.8, line 1+), note that the user navigates through menus and Microprocessor 10, tracks and stores each menu and also items within each menu to dynamically provide different levels of help information based on the mode of operation of a menu.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teaching of Richards into the system of Young to dynamically generate help text or instruction and display help text on each selected tile, item or grid of the EPG data, and furthermore enable interaction with each selected tiles or grid of the EPG data for additional information, help or instructions relating to the selected tile or grid of the EPG data.

Claim 42, is met as previously discussed with respect claim 4.

Claim 43, is met as previously discussed with respect claim 5.

Claim 47, is met as previously discussed with respect claim 13.

Claim 52, is met as previously discussed with respect claim 1, note the current operating mode is a menu as disclosed in Richards.

Claim 53, is met as previously discussed with respect claim 14,

Claim 54, is met as previously discussed with respect claim 27,

Claim 55, is met as previously discussed with respect claim 40.

Claim 56, is met as previously discussed with respect claim 1,

Claim 57, is met as previously discussed with respect claim 14,

Claim 58, is met as previously discussed with respect claim 27.

Claim 59, is met as previously discussed with respect claim 40.

4. Claims 2, 6, 7, 15, 19, 20, 28, 32, 33, 41, 44 and 45, are rejected under 35 U.S.C. 103(a) as being unpatentable over **Young (4,706,121)** in view of **Richards et al (5,179,654)** as applied to claims 1, 14, 27 and 40 above, and further in view of **Palmer et al (6,320,588).**

As to claims 2, 15, 28 and 41, Young as modified by Richards displays a help menu at the bottom of the screen upon receiving a user selection, but fail to explicitly teach displaying a help icon.

However, **Palmer** teaches displaying a help icon on a menu (fig. 23 and col. 19, lines 31-39).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teaching of Palmer into the system of Young as modified by Richards to provide a help icon as a visual mnemonics on the screen for a user-friendly GUI that allows the user to control without having to remember a command or input at a remote control or keyboard.

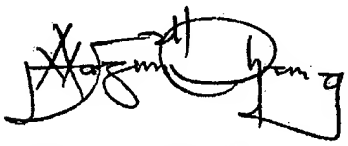
As to claims 6, 7, 19, 20, 32, 33, 44 and 45, Young as modified by Richards fails to explicitly teach where the help information comprises displaying an instructional video or audio that explains to the user how a portion of the EPG operates.

However, Palmer further teaches a menu system, with audio/visual help instruction, which explains how a portion of the menu operates (figs. 23-25, col. 17, line 64-col. 18, line 2, col. 19, lines 31-39 and col. 22, line 63-col. 23, line 1+), note that the help instruction offers the user three levels comprehensive textual, audio and visual system documentation (col. 23, lines 30-39).

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Annan Q. Shang** whose telephone number is **571-272-7355**. The examiner can normally be reached on **700am-400pm**.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Christopher S. Kelley** can be reached on **571-272-7331**. The fax phone number for the organization where this application or proceeding is assigned is **571-273-8300.**

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the **Electronic Business Center (EBC) at 866-217-9197 (toll-free).** If you would like assistance from a **USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.**



Annan Q. Shang

APPENDIX C: Copy of Young et al. U.S. Patent No. 4,706,121

United States Patent [19]

Young

[11] Patent Number: 4,706,121

[45] Date of Patent: Nov. 10, 1987

[54] **TV SCHEDULE SYSTEM AND PROCESS**

[76] Inventor: Patrick Young, 1496 Cherrywood Dr., San Mateo, Calif. 94403

[21] Appl. No.: 860,077

[22] Filed: May 6, 1986

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 754,630, Jul. 12, 1985, abandoned.

[51] Int. Cl.[4] H04N 7/093; H04N 7/08

[52] U.S. Cl. 358/142; 358/146; 358/147; 455/181; 455/186; 340/825.22

[58] Field of Search 358/142, 146, 147, 191.1, 358/189, 84, 85, 86; 455/181, 186; 340/825.22

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,170,782 10/1979 Miller 358/84

4,488,179 12/1984 Krüger et al. 358/147

FOREIGN PATENT DOCUMENTS

2034995 6/1980 United Kingdom 455/186

Primary Examiner—James J. Groody

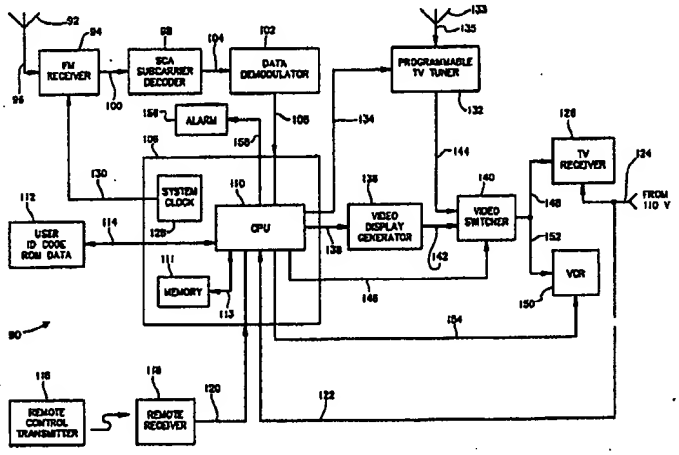
Assistant Examiner—Michael D. Parker

Attorney, Agent, or Firm—Flehr, Hohbach, Test, Albritton & Herbert

[57] **ABSTRACT**

A system (90) controls a television receiver (126) to allow user selection of broadcast programs from schedule information. A data processor (110) is connected to receive the schedule information from an FM receiver (94), decoder (98) and data demodulator (102). A user remote control transmitter 116-remote receiver (118) combination supplies user selection inputs to the data processor (110). The data processor (110) selects programs from the schedule information based on the user inputs. The schedule information for the selected programs is stored in a memory (111), and is used by the data processor (110) to control a programmable TV tuner (132) to provide the broadcast signals for the selected programs to the TV receiver (126) at the time of broadcast. The system (90) can also be used to control a VCR (150) for unattended recording of the selected programs.

56 Claims, 14 Drawing Figures



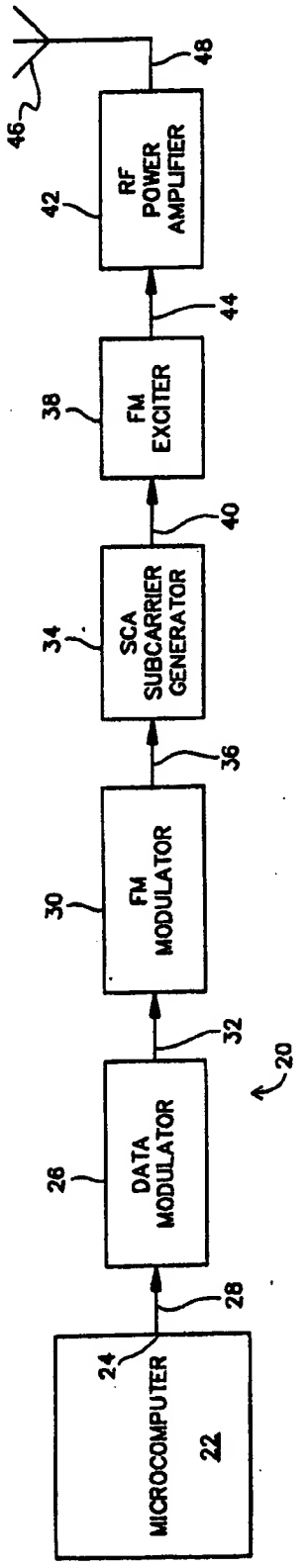

MICROCOMPUTER
22
24
28
DATA MODULATOR
26
32
FM MODULATOR
30
36
SCA SUBCARRIER GENERATOR
34
40
FM EXCITER
38
44
RF POWER AMPLIFIER
42
48
46
20

FIG. 1

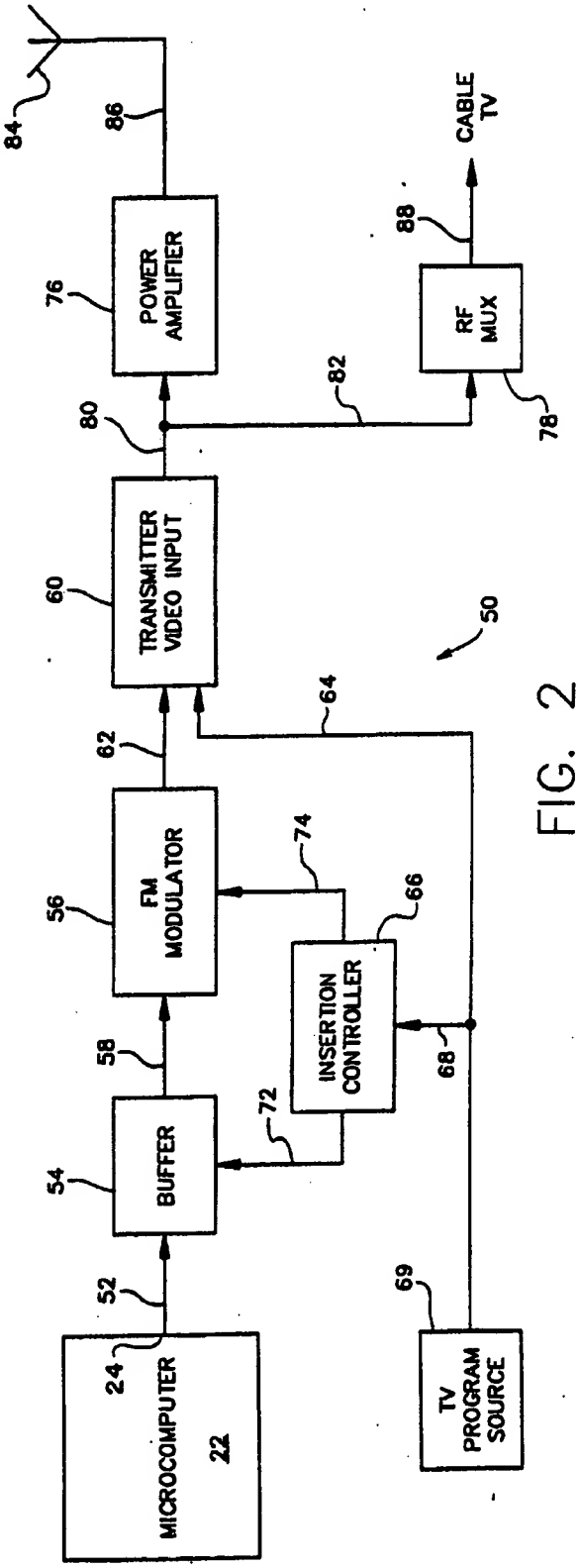
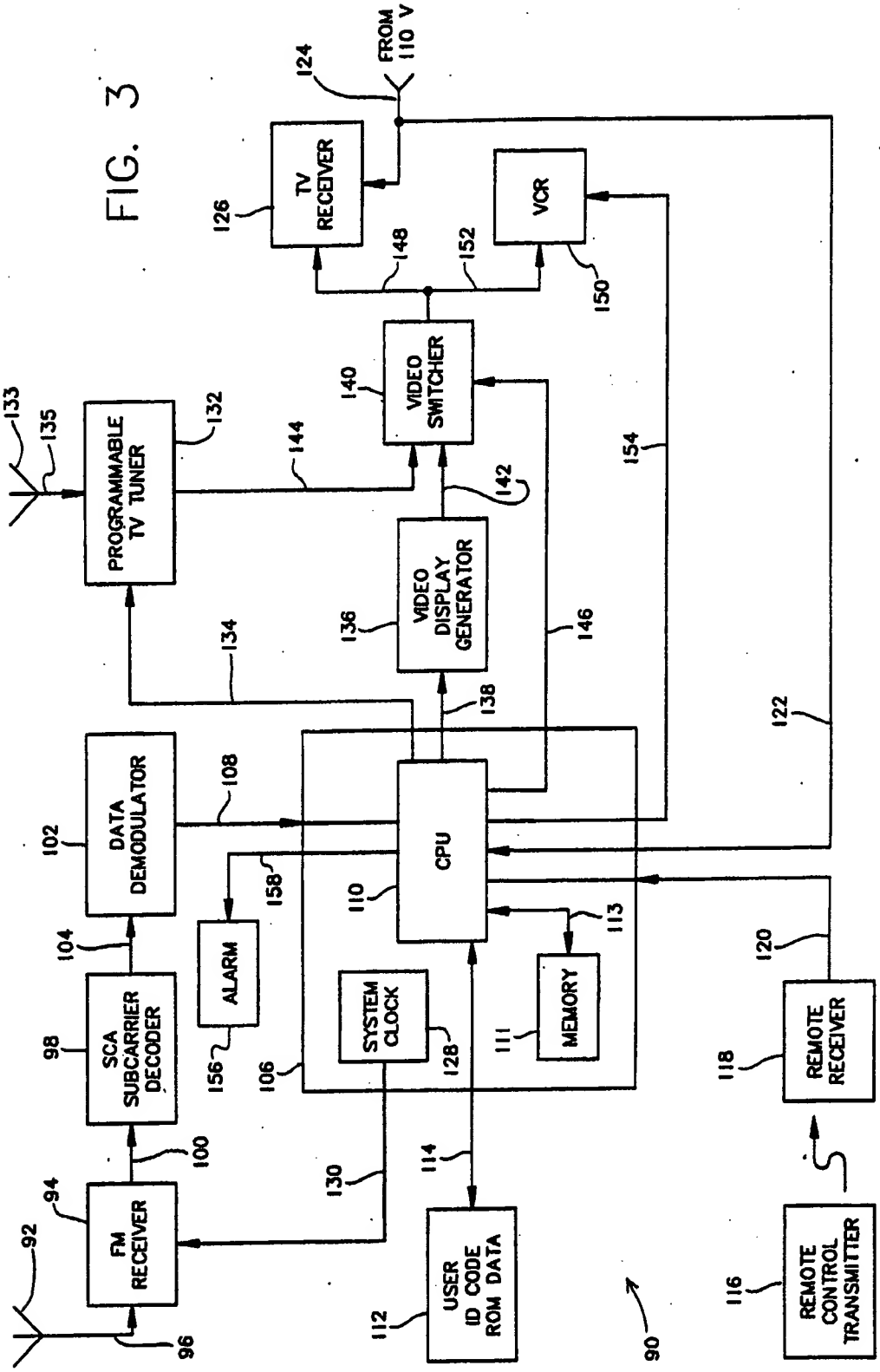

MICROCOMPUTER
22
24
52
BUFFER
54
58
FM MODULATOR
56
62
TRANSMITTER VIDEO INPUT
60
64
POWER AMPLIFIER
76
80
84
86
INSERTION CONTROLLER
66
68
72
74
RF MUX
78
82
88
CABLE TV
TV PROGRAM SOURCE
69
50

FIG. 2

FIG. 3


FROM 110 V
124
TV RECEIVER
126
VCR
148
152
150
VIDEO SWITCHER
140
133
135
PROGRAMMABLE TV TUNER
132
144
142
154
VIDEO DISPLAY GENERATOR
136
146
134
138
122
DATA DEMODULATOR
102
108
CPU
158
110
113
104
ALARM
SYSTEM CLOCK
MEMORY
120
98
SCA SUBCARRIER DECODER
156
106
128
111
REMOTE RECEIVER
118
100
130
114
94
FM RECEIVER
92
96
USER ID CODE ROM DATA
112
90
116
REMOTE CONTROL TRANSMITTER

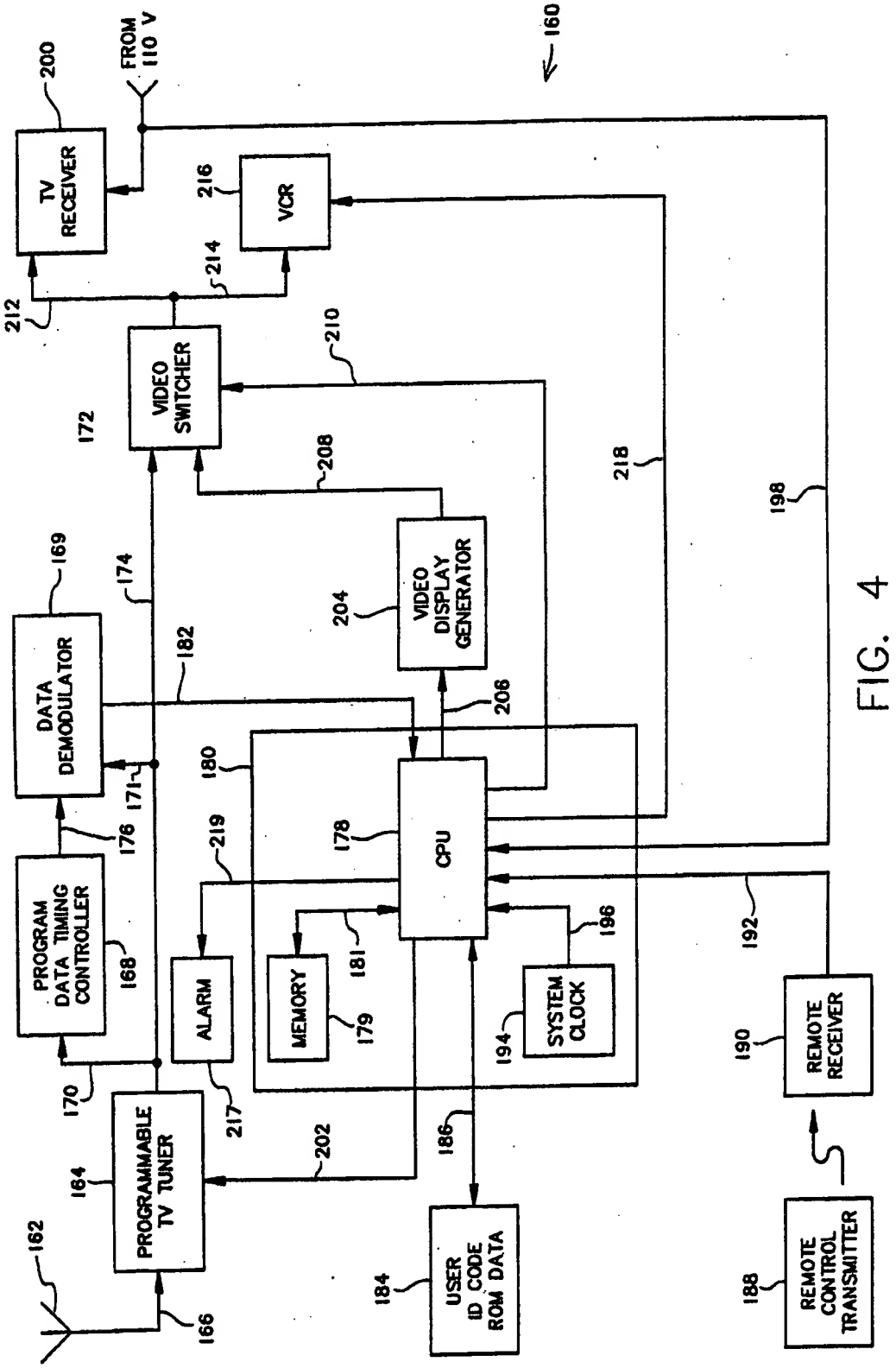

160
FROM 110 V
200
TV RECEIVER
216
VCR
214
212
VIDEO SWITCHER
210
172
208
218
198
169
174
DATA DEMODULATOR
182
204
VIDEO DISPLAY GENERATOR
206
180
171
176
219
178
CPU
PROGRAM DATA TIMING CONTROLLER
168
ALARM
MEMORY
181
179
SYSTEM CLOCK
196
192
194
190
REMOTE RECEIVER
170
217
202
186
164
PROGRAMMABLE TV TUNER
162
166
184
USER ID CODE ROM DATA
188
REMOTE CONTROL TRANSMITTER

FIG. 4

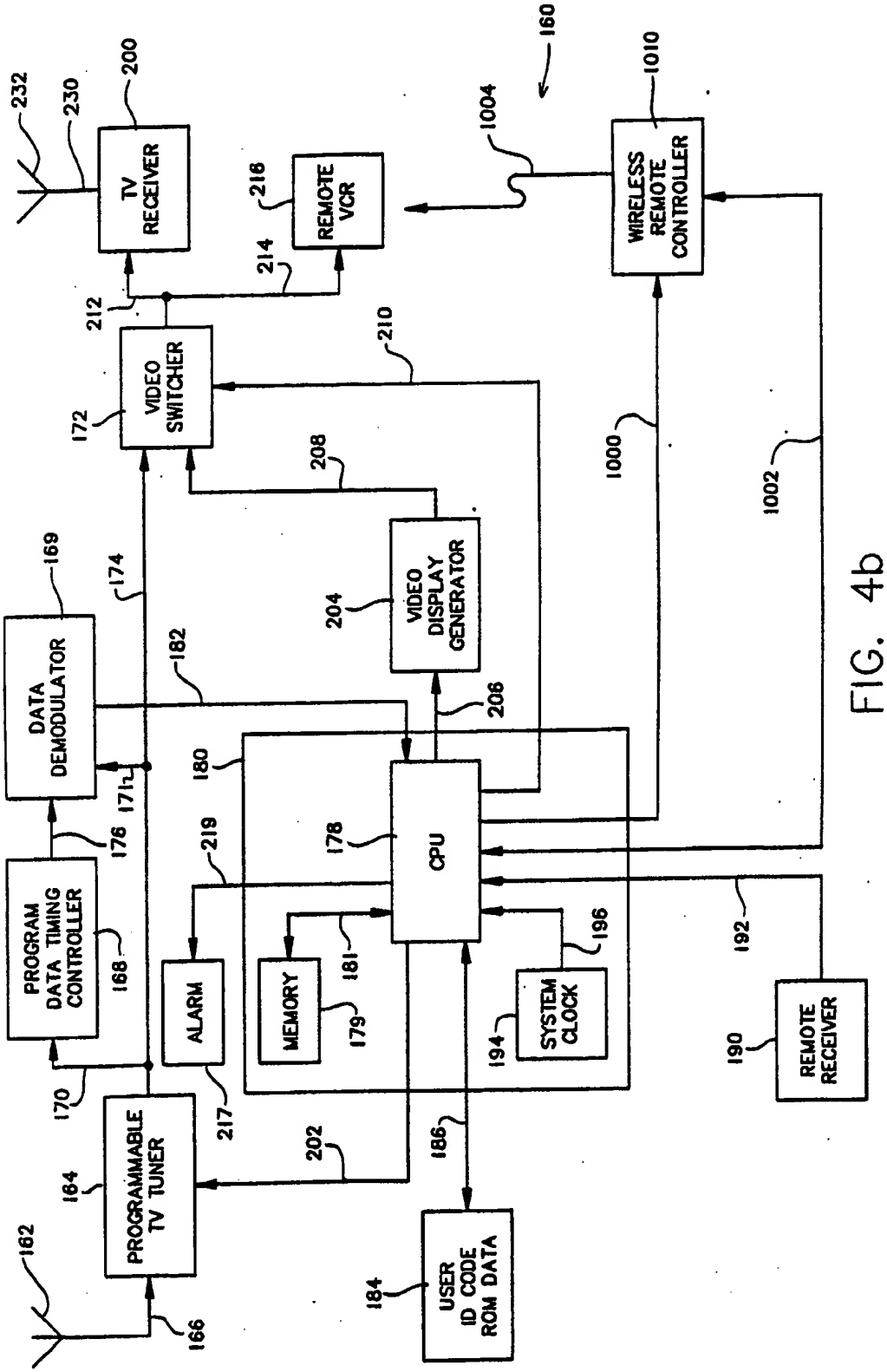

160
1010
WIRELESS REMOTE CONTROLLER
1004
1000
1002
232
230
200
TV RECEIVER
216
REMOTE VCR
214
212
VIDEO SWITCHER
210
172
208
169
174
DATA DEMODULATOR
204
VIDEO DISPLAY GENERATOR
182
206
180
171
176
219
178
CPU
PROGRAM DATA TIMING CONTROLLER
168
ALARM
MEMORY
181
179
196
SYSTEM CLOCK
194
192
190
REMOTE RECEIVER
170
217
202
186
164
PROGRAMMABLE TV TUNER
162
166
184
USER ID CODE ROM DATA

FIG. 4b

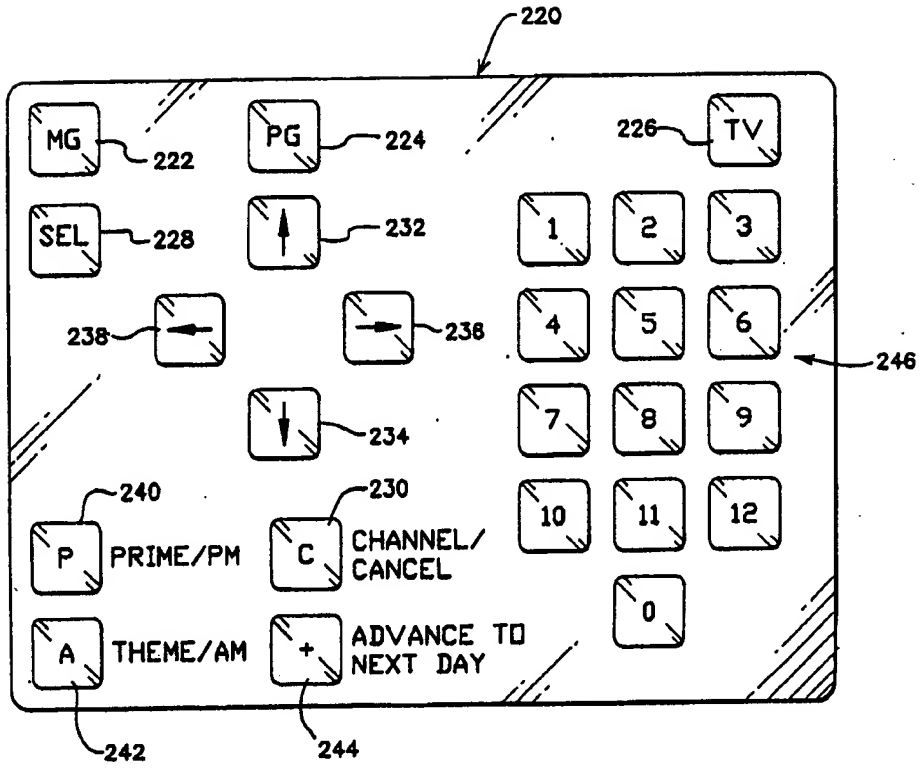

220
MG
222
PG
224
226
TV
SEL
228
232
1
2
3
238
236
4
5
6
246
234
7
8
9
240
230
10
11
12
P
PRIME/PM
C
CHANNEL/
CANCEL
0
A
THEME/AM
+
ADVANCE TO
NEXT DAY
242
244

FIG. 5

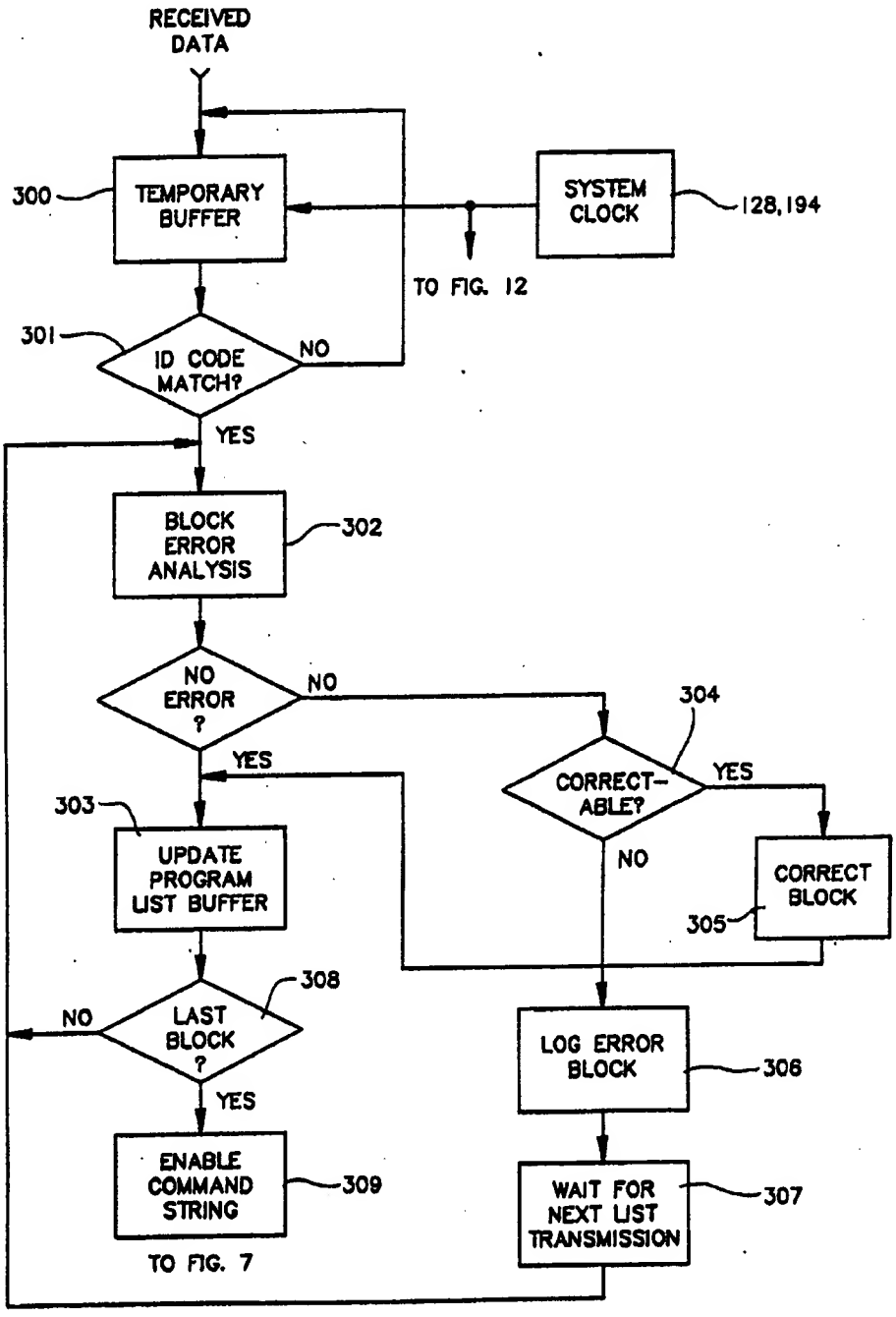

RECEIVED DATA
300
TEMPORARY BUFFER
SYSTEM CLOCK
128,194
TO FIG. 12
301
ID CODE MATCH?
NO
YES
BLOCK ERROR ANALYSIS
302
NO ERROR ?
NO
304
CORRECT-ABLE?
YES
YES
303
UPDATE PROGRAM LIST BUFFER
NO
CORRECT BLOCK
305
308
NO
LAST BLOCK ?
LOG ERROR BLOCK
306
YES
ENABLE COMMAND STRING
309
WAIT FOR NEXT LIST TRANSMISSION
307
TO FIG. 7

FIG. 6

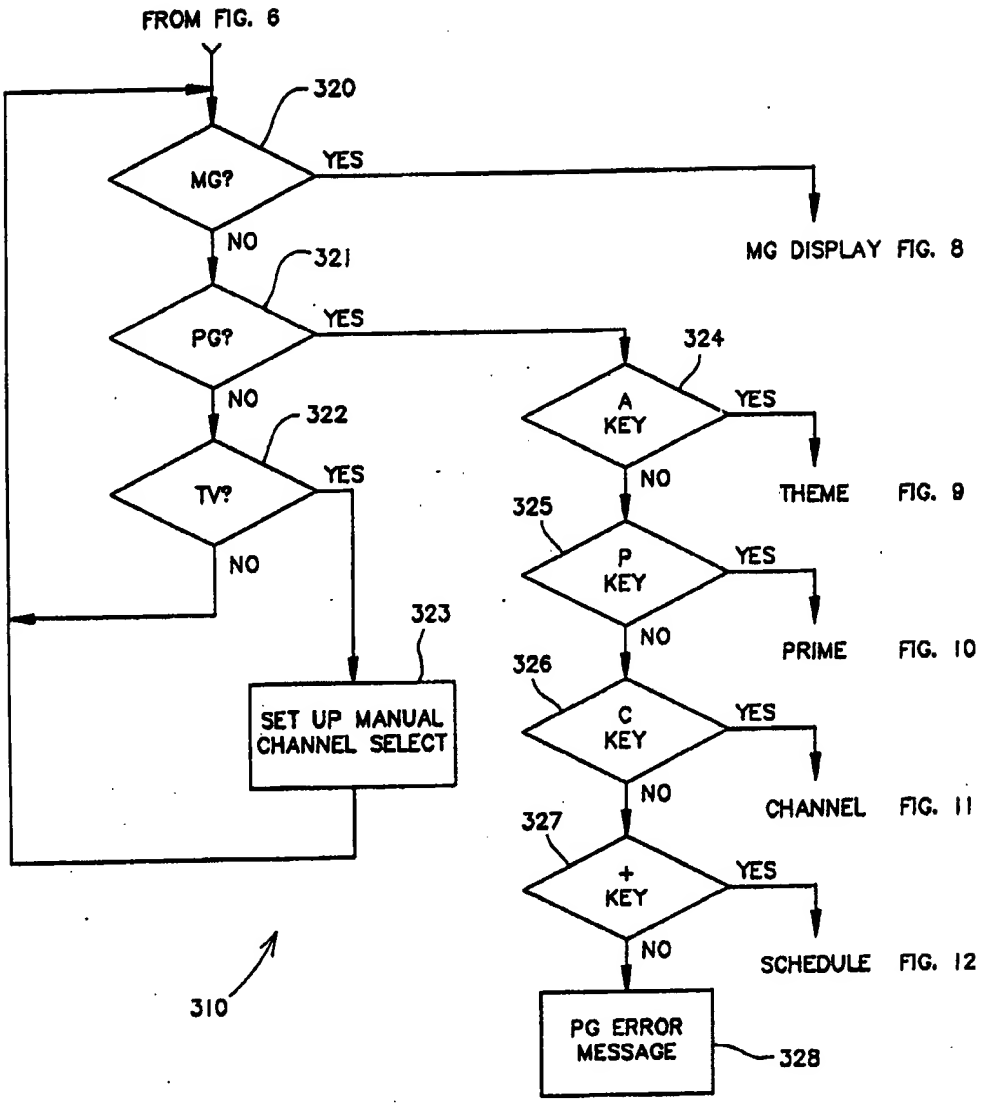

FROM FIG. 6
320
MG?
YES
MG DISPLAY FIG. 8
NO
321
PG?
YES
NO
322
TV?
YES
NO
323
SET UP MANUAL CHANNEL SELECT
310
324
A KEY
YES
THEME FIG. 9
NO
325
P KEY
YES
PRIME FIG. 10
NO
326
C KEY
YES
CHANNEL FIG. 11
NO
327
+ KEY
YES
SCHEDULE FIG. 12
NO
PG ERROR MESSAGE
328

FIG. 7

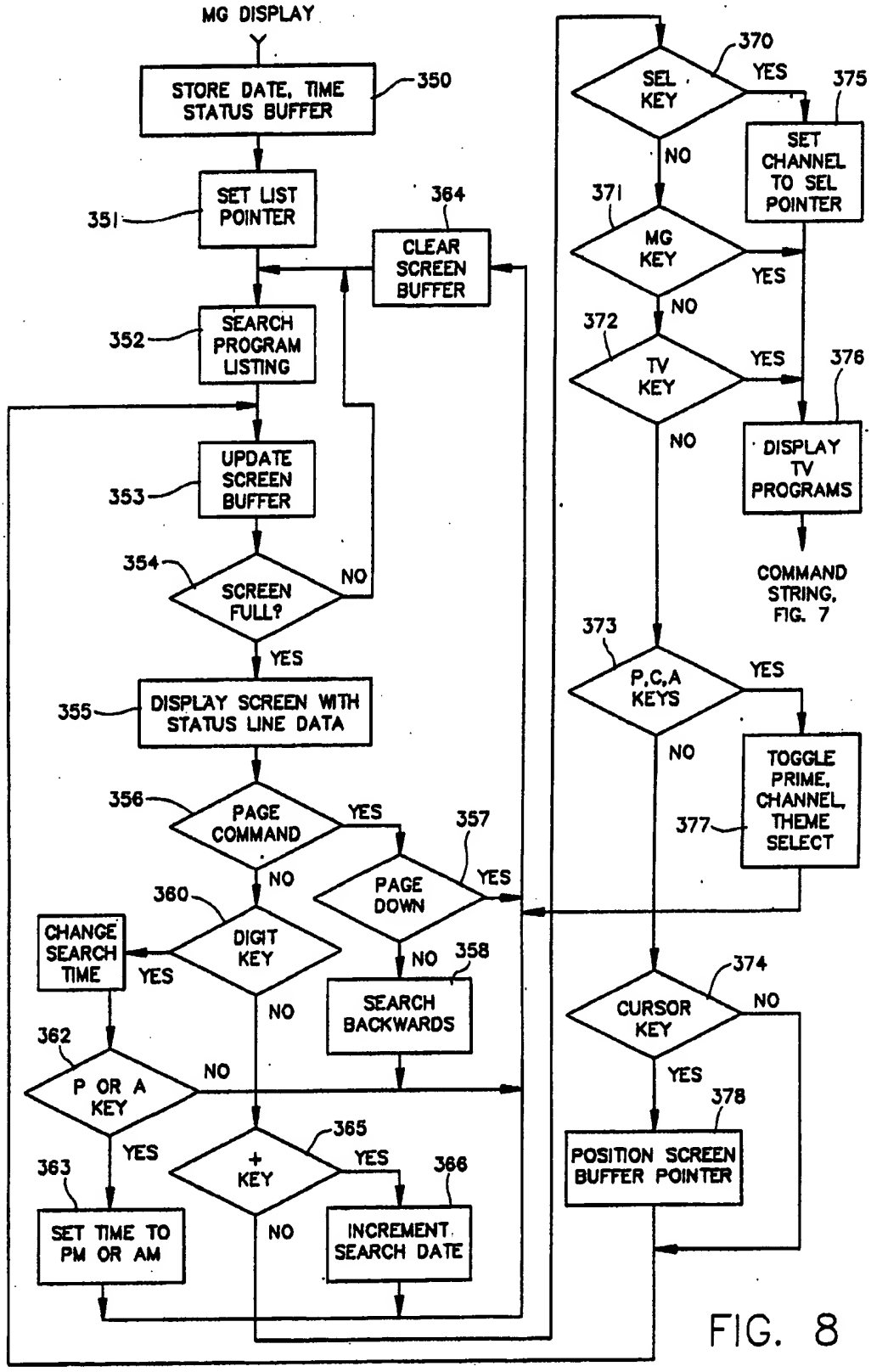

MG DISPLAY
STORE DATE, TIME STATUS BUFFER
350
SET LIST POINTER
351
CLEAR SCREEN BUFFER
364
SEARCH PROGRAM LISTING
352
UPDATE SCREEN BUFFER
353
SCREEN FULL?
354
NO
YES
DISPLAY SCREEN WITH STATUS LINE DATA
355
PAGE COMMAND
356
YES
NO
PAGE DOWN
357
YES
NO
DIGIT KEY
360
CHANGE SEARCH TIME
YES
NO
SEARCH BACKWARDS
358
P OR A KEY
362
NO
YES
+ KEY
365
YES
NO
SET TIME TO PM OR AM
363
INCREMENT SEARCH DATE
366
SEL KEY
370
YES
NO
SET CHANNEL TO SEL POINTER
375
MG KEY
371
YES
NO
TV KEY
372
YES
NO
DISPLAY TV PROGRAMS
376
COMMAND STRING, FIG. 7
P,C,A KEYS
373
YES
NO
TOGGLE PRIME, CHANNEL, THEME SELECT
377
CURSOR KEY
374
NO
YES
POSITION SCREEN BUFFER POINTER
378

FIG. 8

FIG. 9

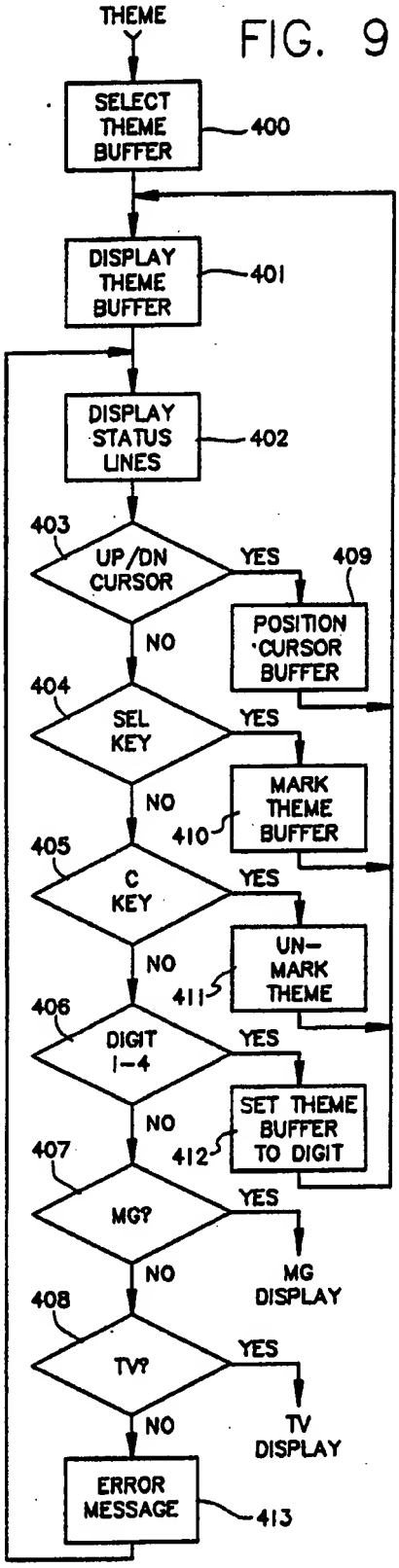

THEME
SELECT THEME BUFFER
400
DISPLAY THEME BUFFER
401
DISPLAY STATUS LINES
402
403
UP/DN CURSOR
YES
409
POSITION CURSOR BUFFER
NO
404
SEL KEY
YES
MARK THEME BUFFER
410
NO
405
C KEY
YES
UN-MARK THEME
411
NO
406
DIGIT 1-4
YES
SET THEME BUFFER TO DIGIT
412
NO
407
MG?
YES
MG DISPLAY
NO
408
TV?
YES
TV DISPLAY
NO
ERROR MESSAGE
413

FIG. 10

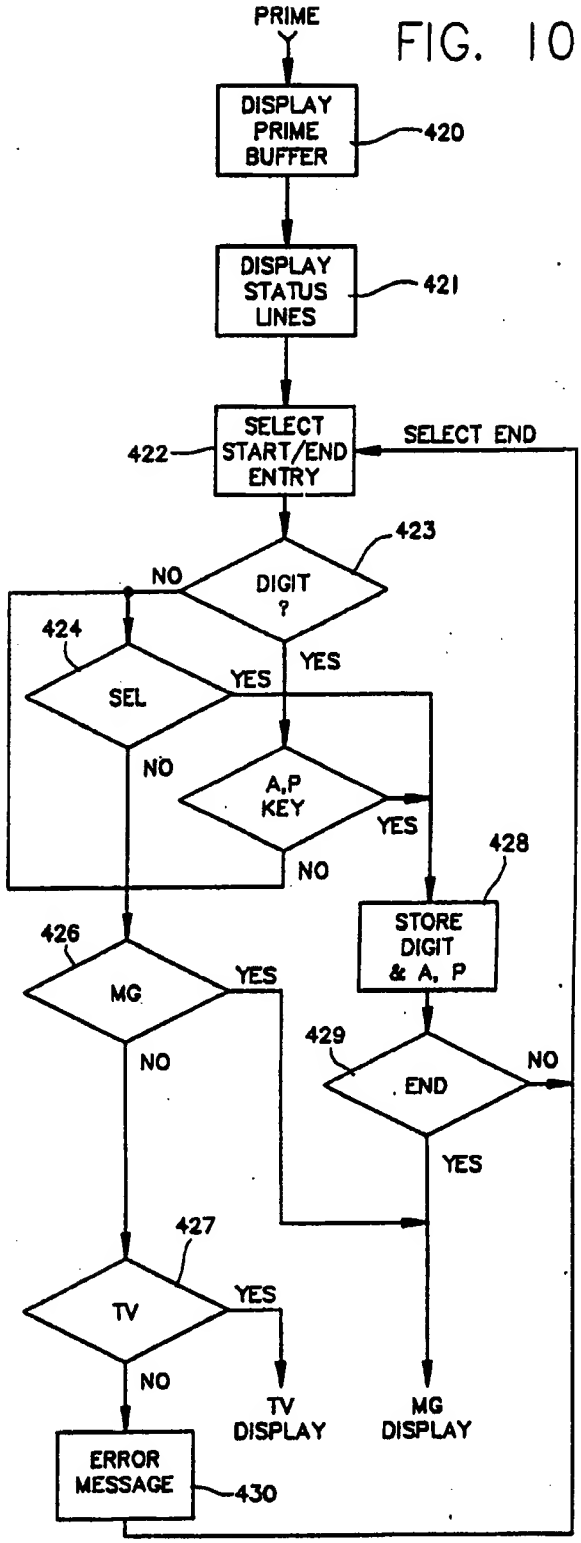
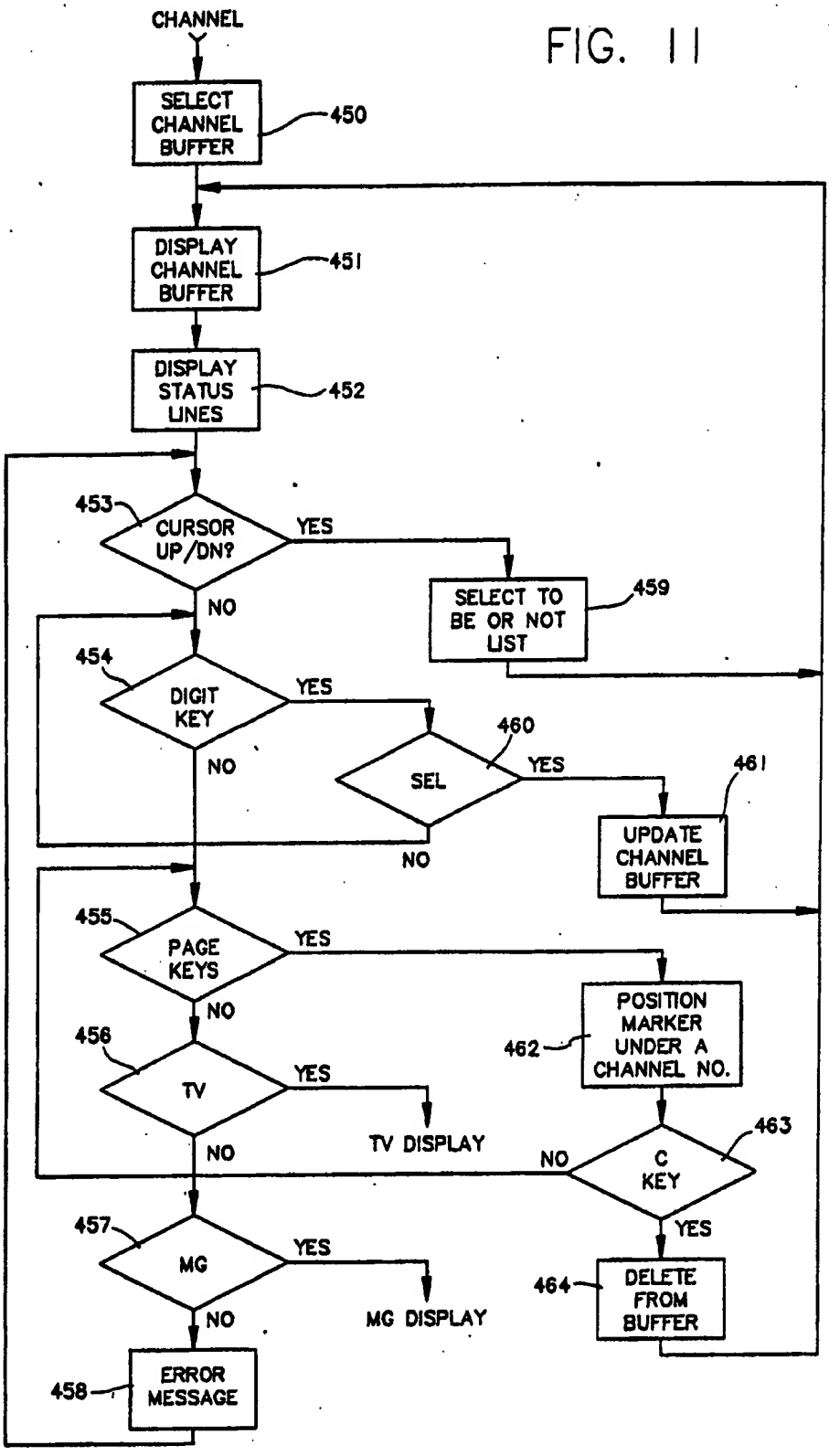

PRIME
DISPLAY PRIME BUFFER
420
DISPLAY STATUS LINES
421
SELECT START/END ENTRY
422
SELECT END
423
DIGIT ?
NO
YES
424
SEL
YES
NO
A,P KEY
YES
NO
428
STORE DIGIT & A, P
426
MG
YES
NO
429
END
NO
YES
427
TV
YES
NO
TV DISPLAY
MG DISPLAY
ERROR MESSAGE
430

FIG. 11


CHANNEL
SELECT CHANNEL BUFFER
450
DISPLAY CHANNEL BUFFER
451
DISPLAY STATUS LINES
452
453
CURSOR UP/DN?
YES
NO
SELECT TO BE OR NOT LIST
459
454
DIGIT KEY
YES
NO
460
SEL
YES
NO
461
UPDATE CHANNEL BUFFER
455
PAGE KEYS
YES
NO
POSITION MARKER UNDER A CHANNEL NO.
462
456
TV
YES
NO
TV DISPLAY
463
C KEY
NO
YES
457
MG
YES
NO
MG DISPLAY
464
DELETE FROM BUFFER
458
ERROR MESSAGE

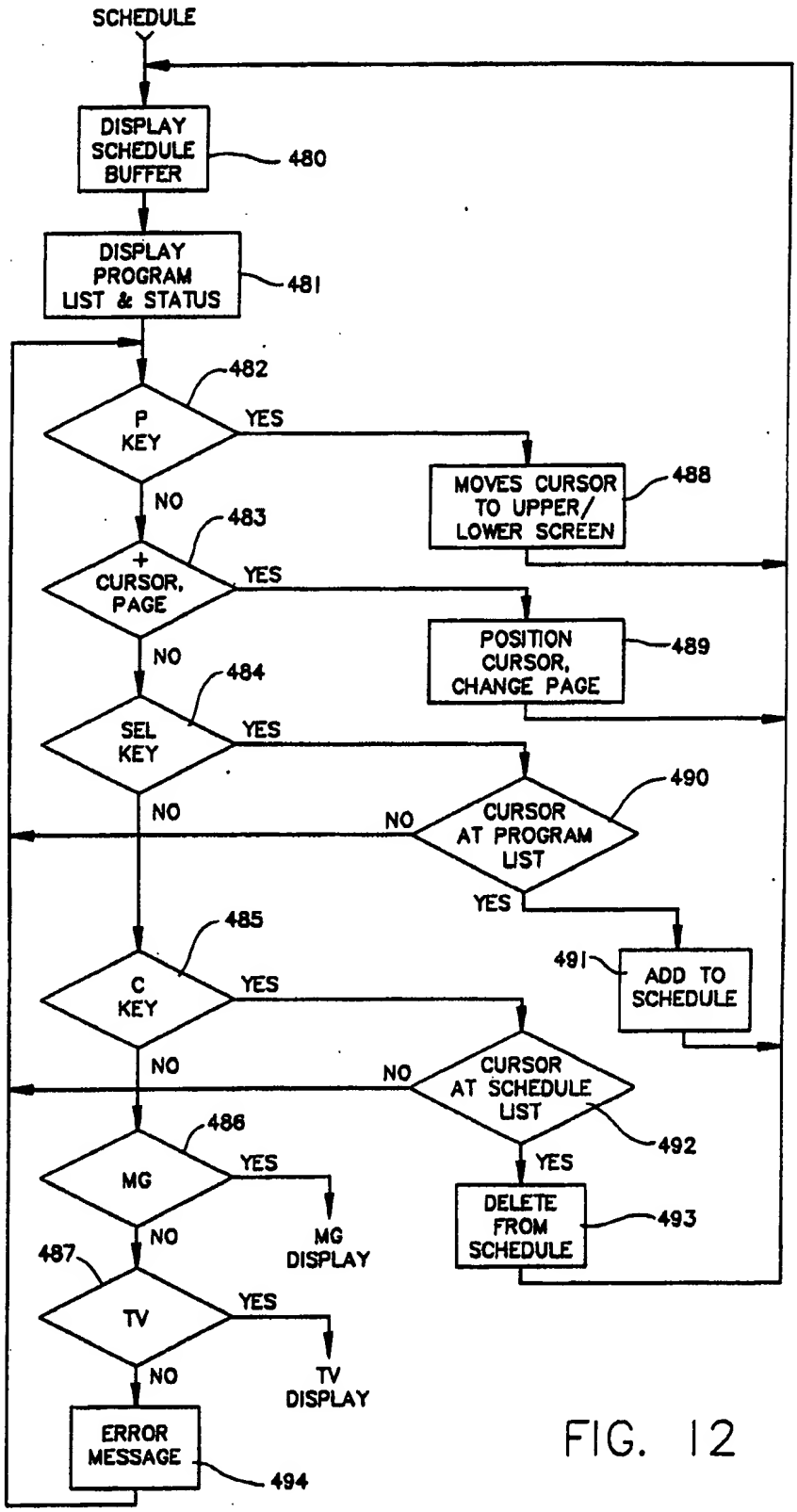

SCHEDULE
DISPLAY SCHEDULE BUFFER
480
DISPLAY PROGRAM LIST & STATUS
481
482
P KEY
YES
MOVES CURSOR TO UPPER/ LOWER SCREEN
488
NO
483
+ CURSOR, PAGE
YES
POSITION CURSOR, CHANGE PAGE
489
NO
484
SEL KEY
YES
490
NO
NO
CURSOR AT PROGRAM LIST
YES
485
491
ADD TO SCHEDULE
C KEY
YES
NO
NO
CURSOR AT SCHEDULE LIST
492
486
MG
YES
YES
DELETE FROM SCHEDULE
493
NO
MG DISPLAY
487
TV
YES
NO
TV DISPLAY
ERROR MESSAGE
494

FIG. 12

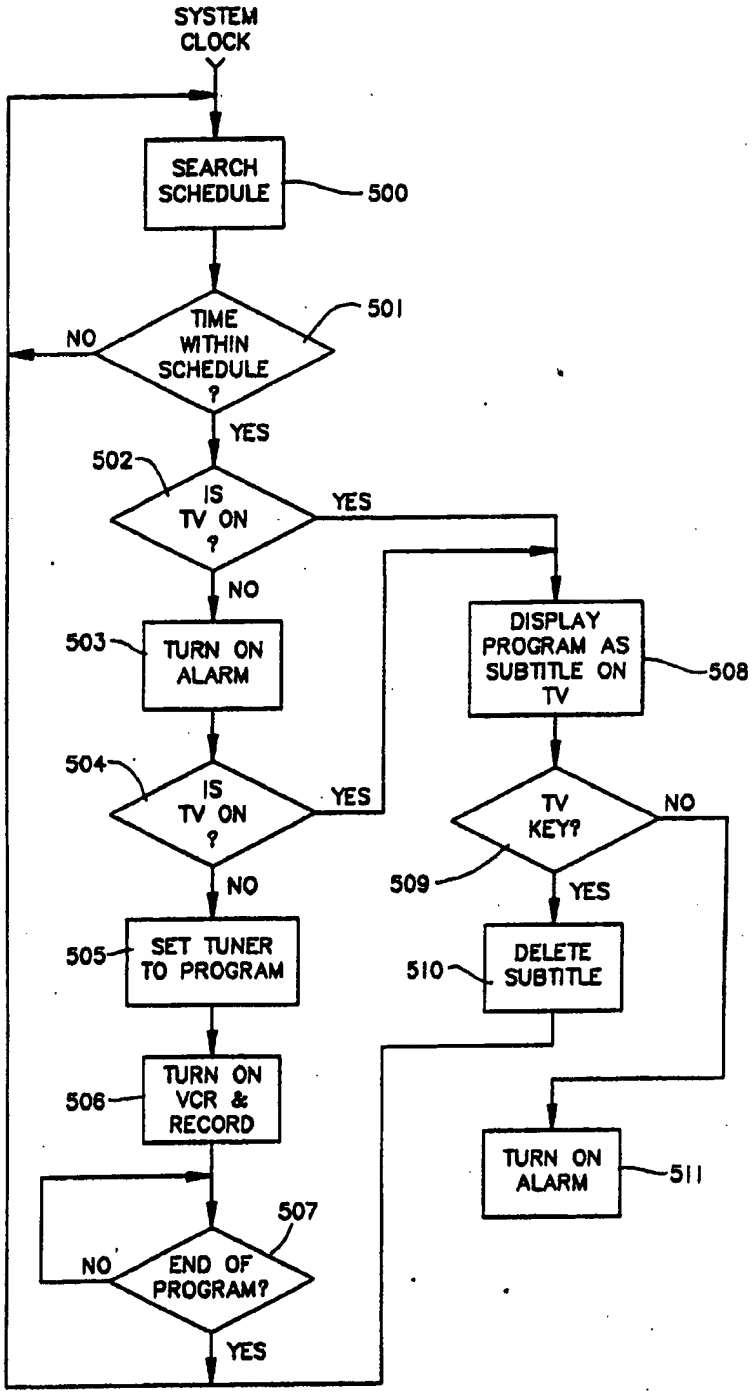

SYSTEM CLOCK
SEARCH SCHEDULE
500
TIME WITHIN SCHEDULE ?
501
NO
YES
IS TV ON ?
502
YES
NO
TURN ON ALARM
503
IS TV ON ?
504
YES
NO
SET TUNER TO PROGRAM
505
TURN ON VCR & RECORD
506
END OF PROGRAM?
507
NO
YES
DISPLAY PROGRAM AS SUBTITLE ON TV
508
TV KEY?
509
NO
YES
DELETE SUBTITLE
510
TURN ON ALARM
511

FIG. 13

TV SCHEDULE SYSTEM AND PROCESS

ORIGIN OF THE APPLICATION

This application is a continuation-in-part of my application Ser. No. 754,630, filed July 12, 1985, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an electronic system and a process for controlling a television set to present programs selected in advance from a schedule by a user. More particularly, it relates to such an electronic system and process which allows the user to make the broadcast program selection using selection criteria that can be combined in different ways. Most especially, the invention relates to such an electronic system and process which receives the schedule information in broadcast form and then processes the schedule information to make the selections. The invention further relates to a system that will enable a user to program a video cassette recorder (VCR) for unattended operation by making a simple selection from a menu.

2. Description of the Prior Art

A variety of electronic systems which can be connected to a conventional television receiver to increase the functionality of the receiver are known in the art. For example, systems that will allow a user to select teletext messages broadcast as auxilliary information in otherwise unused portions of conventional television broadcasts are disclosed in U.S. Pat. No. 4,186,413, issued Jan. 29, 1980 to Mortimer; U.S. Pat. No. 4,288,809, issued Sept. 8, 1981 to Yabe, and U.S. Pat. No. 4,361,848, issued Nov. 30, 1982 to Poignet et al. A variety of other electronic systems for controlling television sets or other related applications are disclosed in the following additional issued patents: U.S. Pat. No. 4,205,343, issued May 27, 1980 to Barrett; U.S. Pat. No. 4,225,967, issued Sept. 30, 1980 to Miwa et al.; U.S. Pat. No. 4,290,062, issued Sept. 15, 1981 to Marti et al.; U.S. Pat. No. 4,430,669, issued Feb. 7, 1984 to Cheung; and U.S. Pat. No. 4,506,387, issued Mar. 19, 1985 to Walter.

As the number of television stations in a metropolitan area or on a cable network has increased, a larger number of programs of potential interest to a viewer is presented. With the use of dish antennas capable of receiving direct satellite signals, the multitude of programs available to the viewer is further increased. At the present time, the user must consult a published program guide, such as TV Guide Magazine or program listings published in newspapers, in order to select programs for viewing. Particularly if the viewer is interested in a special category of program broadcast at irregular intervals, such as tennis tournaments, being aware of programs of special interest and selecting them for viewing is often difficult. Should the viewer find a program of interest which is broadcast at a time when the viewer will be unable to view the program, the user must then set a VCR or other recording device to record the program for viewing at a more convenient time. Often, a viewer will notice a program of special interest in the program listing, but forget to select the appropriate channel for viewing at the time of broadcast or set the VCR to record the program, or the length of the program for proper operation of the VCR to record the program. If there is more than one program to be recorded, it is easy to select programs with

conflicting time schedules, with two or more programs overlapping each other. Conventionally published program listings are not capable of handling last minute schedule changes and additions. For these and other reasons, it would be advantageous if the viewer could select and view, or perform unattended recording of programs of interest in an easier and more dependable fashion.

Significant problems are encountered by users of VCRs as presently operated. Programming a VCR for unattended operation requires considerable skill and care. It is necessary to select the station, the day of the week, the time, including a.m. or p.m., and the length of the program for each program to be recorded. The process is even more complex if the user wishes to set the VCR for automatic recording of a program in the future at a given time while watching another program at the same time. Mary VCR owners are unable to master the complexities of setting the VCR for unattended operation, and simply do not use that feature of the equipment. Almost all users, at one time or another, have recorded the wrong program through an inadvertent incorrect setting of the VCR.

While a variety of systems incorporating VCRs and VCR control systems are known in the art, none deal with the complexity of setting a VCR for unattended recording. U.S. Pat. No. 4,523,295, issued June 11, 1985 to Zato discloses a VCR control system including a nonvolatile memory for storing user programmed system timing information in the event of a power outage. Other systems including VCRs are disclosed in the following issued U.S. Pat. Nos.: 4,272,791, issued June 9, 1981 to Rifken and U.S. Pat. No. 4,530,048, issued July 16, 1985 to Proper.

In most metropolitan areas, a large variety of cable programming is available. Since a cable channel will provide its signal on different numbered channels in different areas, depending on which channels are otherwise unused, programming for the cable channels is disseminated on a national or regional basis by the name of the channel, rather than the particular channel number on which the signal is supplied, while the television set must be tuned by the channel number. In the San Francisco metropolitan area, for example, there are presently 15 different cable channels that are listed by name, not channel number. A viewer will often not remember the channel number on which a given cable service is furnished, especially if that service is only watched occasionally. U.S. Pat. No. 4,405,946, issued Sept. 20, 1983 to Knight, discloses a system for providing an on-screen display of channel numbers or an indication that a signal is coming from a recording device, but with no teaching or suggestion of displaying a cable channel by name rather than number.

When satellite broadcasts are considered, the situation becomes even more complex. Satellite TV guides list all programs of satellites broadcast in the U.S. by the hour. Fifty or more programs may be listed under each hour or half hour heading. Depending on such factors as geographic location and equipment capability, many users will only be able to receive a small fraction of the listed programs. It would be desirable for a user to be able to reduce the number of such listings to be consulted in making a program selection. It would also be desirable for the viewer to be able to eliminate listings for encrypted programs for which the user is not a subscriber.

SUMMARY OF THE INVENTION

Accordingly, it is an object of this invention to provide a system and process which allows a user to control a television set by selecting broadcast programs for viewing from schedule information with user-supplied selection criteria.

It is another object of the invention to provide such a system and process which receives the schedule information as a broadcast.

It is another object of the invention to provide such a system and process which is capable of accommodating last minute schedule changes and additions.

It is a further object of the invention to provide such a system in which the user supplied selection criteria can be combined by the system to make program selection.

It is a still further object of the invention to provide such a system and process in which the selection criteria can be either criteria of inclusion or exclusion.

It is another object of the invention to provide such a system and process in which the need to make manual channel selection is eliminated and all programs are selected by pointing to menu items.

It is still another object of the invention to provide such a system and process which will determine if the television set is turned on at the time of the selected broadcast program and automatically supply the selected program to a VCR or other program recording device if the television set is not turned on.

Independently of the television set, it is another object of the invention to provide greatly simplified and reliable unattended recording of television programs.

It is a still further object of the invention to provide such a system and process which is capable of selecting a single program in a multiple program series and automatically including the rest of the programs in the series.

It is another object of the invention to provide such a system and process which will automatically terminate selection of a series of programs when the last program of the series has been completed.

It is yet another object of the invention to provide such a system and process which will automatically perform unattended recording of a program of uncertain length, such as a sporting event, and terminate the recording as soon as the program of uncertain length has been completed.

It is a further object of the invention to provide such a system and process which will allow certain programs and/or channels to be excluded from the selection unless the user enters a coded password.

It is still another object of the invention to provide such a system and process in which such user selections are used for unattended, automatic operation of a VCR or other recording device.

It is a still further object of the invention to provide such a system and process controlling a VCR in which the user selections are used for automatic, preselected recording of one program on a VCR while the user is viewing another program on a television set.

It is yet another object of the invention to provide such a system and process in which all parameters of a program for viewing and/or recording can be set with a single user selection.

It is a further object of the invention to provide such a system and process in which the user is not required to leave the VCR powered on for unattended recording.

It is a still further object of the invention to provide such a system and process in which the user is notified of conflicting time schedules for programs selected for viewing and/or recording.

It is another object of the invention to provide such a system and process in which a user identification system is employed to ensure pay subscription to the TV schedule system.

It is still another object of the invention to provide such a system and process in which special program linking and theme information is broadcast in order to allow easier program selection by the user.

It is a further object of the invention to provide such a system and process in which actual names of channel services, such as HBO, ESPN and the like, are displayed to the viewer and by which the viewer may select the channel service, in place of channel numbers on which such services are supplied.

It is still another object of the invention to provide such a system and process in which unique schedule data, such as linking, theme, satellite and channel name, satellite encryption, scrambled transmission, is supplied as a basis for the user to select listings for viewing and/or recording.

It is a still further object of the invention to provide such a system and process in which the length of time since a program being broadcast has started and how much time remains for the program is displayed to the user when the user turns on the program.

The attainment of these and related objects may be achieved through use of the novel electronic system and process for controlling a television receiver to allow user selection of broadcast programs herein disclosed. As used herein, the term "broadcast" refers not only to transmission by airwaves, but also to other forms of transmission, such as by cable. A system for controlling a television receiver to allow user selection of broadcast programs from schedule information in accordance with the invention includes a data processor. A first input means for the schedule information is connected to the data processor. A second user selection input means is also connected to the data processor. The data processor is configured to select programs from the schedule information based on user inputs. A storage means is connected to receive the schedule information for programs selected by the data processor. A programmable tuner is provided for connection to the television receiver. The programmable tuner is connected to receive control signals from the data processor for causing the programmable tuner to supply broadcast signals for the selected programs to the television receiver at the time of the selected program broadcasts.

The process of this invention includes the following steps. Program schedule information is supplied to a data processor. User program selection criteria are supplied to the data processor. The user selection criteria are used to select programs for viewing from the program schedule information in the data processor. The stored information is used to tune the television receiver to the selected programs.

In a preferred form of a system and process in accordance with the invention, the schedule information is also broadcast, either during an otherwise unused portion of a conventional television broadcast, such as during a horizontal or vertical flyback interval, or as a separate broadcast, such as a frequency modulation (FM) broadcast. The preferred system includes a video display generator connected to receive signals from the

data processor for generating a video display from the schedule information and the user selections on the television receiver. The video display generator is connected to supply video display signals to a video switcher. The programmable tuner is also connected to supply the broadcast program signals to the video switcher. The data processor is configured and connected to control the video switcher to supply the broadcast program signals and/or the video display signals as required in operation of the system to the television receiver. In its preferred form, the data processor of the system is further configured to provide signals to the video display generator for presenting a plurality of user selection menus on the television receiver. The second user selection input means includes a plurality of keys for making selections from the menus for use in choosing programs from the scheduled information.

Once the system has been used by a viewer to make program selections on the basis of the viewer selected criteria, the system operation can be purely automatic, so that programs of special interest are not missed through forgetfulness. Because the system will search through a volume of schedule information to find programs meeting the viewer's selection criteria, the program selection is much easier and more rapid with the system of this invention than with manual selection. By way of example, the system can be used to select satellite programs from a larger list of satellite programs by user selected satellite symbols, such as F1 or AB, to be displayed by the scheduler, eliminating most of the program listings that are of no value to the viewer. Similarly, for viewers without special decryption service, the system will remove from display those satellite listings which are of no value to the viewer because they are encrypted.

In another aspect of the invention, the system can be automatically linked to a VCR, so that menu selection of programs to record replaces the often confusing techniques required to the unattended operation features of the VCR. By selecting a desired program for recording from a menu display, the chance for error is practically eliminated. The viewer can verify the programs to be recorded by a display of the names of the programs. In the event of a schedule change at the station, the system will automatically update the schedule change and revise the time of the unattended recording. In one form of this aspect of the invention, the system is connected to the remote control facilities of a VCR to turn on its power, start the recording, and stop recording of programs on the VCR. The user is therefore not required to leave the VCR powered on for unattended recording. In this manner, a conventional remote control VCR is connected in the system without modification for unattended recording of scheduled programs.

The attainment of the foregoing and related objects, advantages and features of the invention should be more readily apparent to those skilled in the art after review of the following more detailed description of the invention, taken together with the drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a transmitter for use with a system and process in accordance with the invention.

FIG. 2 is a block diagram of another transmitter for use with another embodiment of a system and process in accordance with the invention.

FIG. 3 is a block diagram of a system in accordance with the invention for use with the transmitter of FIG. 1.

FIG. 4 is a block diagram of another system in accordance with the invention for use with the transmitter of FIG. 2.

FIG. 4B is a block diagram of a modified form of the system in FIG. 4, which also is used with the transmitter of FIG. 2.

FIG. 5 is a plan view of a control panel used in the systems of FIGS. 3–4.

FIGS. 6–13 are flow charts of software used with the systems shown in FIGS. 3–4.

DETAILED DESCRIPTION OF THE INVENTION

1. General System and Process Description

Turning now to the drawings, more particularly to FIG. 1, there is shown a frequency modulation (FM) transmitter 20 for supplying TV schedule information as an FM broadcast. This form of a transmitter allows the necessary schedule information to be broadcast independently of the television broadcasts themselves. Other than making schedule information available to the provider of the FM broadcasts, this form of transmission does not require the cooperation of the television networks or stations. The transmitter 20 includes a microcomputer 22, connected by means of a serial input/output (I/O) port 24 to data modulator 26 by means of line 28. The microcomputer 22, which may be implemented with essentially any commerically available microcomputer, such as an IBM PC/AT or compatible, supplies the television schedule information as digital output signals to the data modulator 26. The data modulator 26 converts the digital outputs of the microcomputer 22 to a form in which they can be used to generate FM signals. The output of data modulator 26 is supplied to an FM modulator 30 on line 32. The FM modulator 30 generates a set of frequency modulated signals corresponding to the data, which are supplied to an SCA subcarrier generator 34 on line 36. The generator 34 produces the SCA subcarrier and applies the frequency modulated signals to the SCA subcarrier. The output of generator 34 is supplied to an FM exciter 38 on line 40. The exciter 38 generates the required FM broadcast signals, which are supplied to an RF power amplifier 42 on line 44. The power amplifier amplifies the FM broadcast signals and supplies them to transmitting antenna 46 on line 48. The data modulator 26, FM modulator 30, SCA subcarrier generator 34, FM exciter 38 and RF power amplifier 42 are all implemented with commercially available system components conventionally employed for broadcast of data processing information signals. Since the design and implementation of the system 20 is itself conventional, and the novelty resides in the particular data processing information signals broadcast with the system 20, the design and operation of the system 20 will not be described in further detail.

FIG. 2 is a block diagram of a similar system 50 that is used to broadcast the television schedule information as part of an otherwise conventional television broadcast, using a normally unused portion of the TV frame, such as the horizontal or vertical flyback. The I/O port 24 of the microcomputer 22 is connected by line 52 to a buffer 54, which converts the digital schedule information signals supplied by the microcomputer to a form suitable for FM modulation. The output of buffer 54 is

supplied to an FM modulator 56 on line 58. The frequency modulated schedule information signals are provided by the modulator 56 for incorporation in the unused portion of the television broadcast in a transmitter video input unit 60 on line 62. Signals for a TV program to be broadcast are also supplied to the video input unit 60 on line 64 and to an insertion controller 66 on line 68 by program source 69, consisting of TV guide data as well as identification codes, in the case of pay subscriber service. The identification code is a unique 6 or 7 digit code for every subscriber. By deleting the identification code, an unpaid subscriber is prevented from receiving the TV guide data. The insertion controller 66 utilizes the program signals to generate synchronizing signals for the unused portions of the TV frame, which are supplied to the buffer 54 and the modulator 56 on lines 72 and 74, respectively. The combined program and schedule information broadcast signals are supplied by the transmitter video input unit 60 to a power amplifier 76 and an RF multiplexer 78 on lines 80 and 82, respectively. The amplified broadcast signals are supplied by amplifier 76 to a transmitting antenna 84 on line 86. The broadcast signals are supplied by multiplexer 78 as cable television signals at output 88. As in the case of the system 20, the system 50 is implemented with conventional system components. The system 50 is of a type conventionally employed for the broadcast of teletext signals in unused portions of a television program broadcast signal, and the novelty resides in the particular teletext signals broadcast in this manner. The design and operation of the system 50 will therefore not be explained in further detail.

FIG. 3 is a block diagram of a receiver and television receiver control system 90 which is used in combination with the FM transmitter system 20 of FIG. 1. An FM antenna 92 receives the broadcast signals from the system 20, which are supplied to FM receiver 94 on line 96. FM receiver 94 supplies the FM broadcast signals to an SCA subcarrier decoder 98 on line 100. The decoder 98 strips the schedule information signals from the FM broadcast signals and supplies the schedule information signals to a data demodulator 102 on line 104. The data demodulator 102 converts the schedule information signals to digital form and supplies the digital schedule data signals to system control unit 106 on line 108, more particularly, to CPU 110 of the system control unit 106. A memory 111 is connected to the CPU 110 at 113. A control program for the system control unit 106 and a user identification code are stored in a read only memory (ROM) 112. ROM 112 communicates with the CPU 110 on line 114. Other inputs to the CPU 110 are supplied by a remote transmitter controller 116-remote receiver 118 combination on line 120, which supplies user selection and other user inputs to the CPU 110, and on line 122, connected to power input 124 of television receiver 126, which allows CPU 110 to determine if the receiver 126 is turned on. System clock 128 of the system control unit 106 is connected to the FM receiver 94 by line 130.

The CPU 110 supplies control outputs, based on user selections, to a programmable TV tuner 132 on line 134. Information identifying programs selected from the schedule information on the basis of the user selection criteria is stored in memory 111 by the CPU 110. The CPU retrieves the information at the appropriate time for generating the control outputs. The tuner receives conventional TV broadcast signals from antenna 133 on line 135. The CPU 110 supplies information signals from the program schedule data on line 108, control program inputs on line 114 and user inputs on line 120 to a video display generator 136 on line 138. Output video display signals from the generator 136 are supplied to a video switcher 140 on line 142. The video switcher also receives TV program signals from tuner 132 on line 144, and a control signal for switching between the tuner 132 and the generator 136 on line 146 from the CPU 110. The video switcher 140 supplies the signals from the tuner 132 or the generator 142 to the TV receiver 126 on line 148 and to a video cassette recorder (VCR) 150 on line 152. The CPU 110 is connected to the VCR 150 by line 154, for turning on the VCR. For most VCRs, the line 154 should be connected to the pause input of the VCR. The CPU is connected to an alarm 156 by line 158 for indicating to a user a short time (e.g., five minutes) before a selected program is to be broadcast that the TV receiver 126 should be turned on if it is off, so that the selected program can be viewed. The operation of the receiver system 90 will be explained further in the explanation of the construction and operation of the controller 116 in connection with Figure 5.

FIG. 4 is a block diagram of another receiver system 160, which may be used with the transmitter system 50 shown in FIG. 2. Antenna 162 receives the TV broadcast signal from the transmitter system 50 and supplies it to a programmable TV tuner 164 on line 166. The tuner 164 supplies the broadcast signal to a program data timing controller 168 on line 170, to data demodulator 169 on line 171 and to a video switcher 172 on line 174. The output of controller 168 is supplied to the demodulator 169 on line 176. The demodulator 169 supplies the program schedule information signals, which have been stripped from the TV broadcast signals and digitized, to CPU 178 of system control unit 180 on line 182. A memory 179 is connected to the CPU 178 at 181 to receive selected program information and to supply the selected program information at the appropriate time for the CPU 178 to generate control signals for the programmable tuner 164. User ID code and control program inputs to the CPU are provided by ROM 184 on line 186. User program selections and other user inputs are provided by a remote control transmitter 188-remote receiver 190 combination on line 192. Other inputs to the CPU 178 are supplied by system clock 194 on line 196, and on line 198, connected to the power supply for TV receiver 200, in order to allow CPU 178 to determine if the TV receiver 200 is turned on. From the user inputs on line 192 and the control program, the CPU generates control signals for the programmable TV tuner 164, which are supplied on line 202, and video display information signals, which are supplied to video display generator 204 on line 206. The generator 204 converts the video display information signals to video display signals, which are supplied to the video switcher 172 on line 208. The CPU 178 supplies control signals for the video switcher 172 on line 210 to switch the video signal outputs of the video switcher 172 on lines 212 and 214 to the TV receiver 200 and VCR 216 between the schedule information video signals from generator 204 and the program video signals from tuner 164. The CPU 178 provides a control signal for turning on the VCR on line 218 when a desired television program signal is being received by tuner 164 and CPU 178 determines from the input on line 198 that TV receiver 200 is not turned on. The CPU 178 is connected to alarm 217 by line 219 for providing an audible signal to a user shortly before broadcast of a selected program if

the TV receiver 200 is turned off, as a signal to turn it on. The operation of the cable TV or TV program receiver system 160 will be described further below in connection with FIGS. 5–13.

FIG. 4B is a block diagram of a modified form of the receiver 160, which may also be used with the transmitter system 50 shown in FIG. 2. In the FIG. 4B receiver 160, a remote VCR 216 and its wireless remote controller 1010, so that the remote VCR 216 need not be powered up in advance of unattended recording. The remote controller 1010 is connected by lines 1000 and 1002 to CPU 178. In response to the CPU 178, the remote controller 1010 transmits control signals to the remote VCR 216 in a conventional manner, as indicated at 1004. The remote controller 1010 can be either a unit designed for the VCR, but modified to be electrically operated from the TV scheduler, or it can be an equivalent design of the remote controller with direct connections to the CPU 178. Instead of enabling the VCR from the pause line 214, when the CPU 178 determines that a program is to be recorded (see, e.g., block 501 of FIG. 13) according to the selected programs, it issues a control signal to power up the VCR on control line 1000. This control signal generates a contact closure across the switch matrix of the remote controller 1010 power-on key. The contact closure may be obtained with a relay or an FET transistor switch. The control signal on line 1000 also generates a contact closure across the play key and the record key of the controller 1010 to initiate recording of the program. When the program ends, CPU 178 will issue a control signal on line 1002. Line 1002 generates a contact closure across the remote controller power-off key. When the CPU 178 determines another program is to be recorded, the above process is repeated.

In order to carry out background recording of a program while watching another program on the TV receiver 200, line 212 is connected to the AUX input of the TV set 200. To receive a normal broadcast while using the TV scheduler to record TV programs in the background, the I; AUX input switch is set to connect antenna 232 to the TV receiver 200. The VCR 216 can now record the scheduled programs without interfering with normal TV viewing.

2. Summary of Keyboard Operation

FIG. 5 shows the layout of keyboard 220 used in the remote control transmitters 116 and 188 of FIGS. 3 and 4. The keys 222–244 have the following significance:

MG 222: Master Guide for direct listing and immediate selection of program.

PG 224: Program Guide for setting up stored features and accessing help information.

TV 226: Selects conventional channel selection.

SEL 228: Selects program from menu to be displayed on TV

C 230: Cancels stored program in the PG mode; toggles channel restriction on and off in the MG mode.

↑ 232: Moves pointer to top of listing; auto scrolls to previous page if pressed when pointer is on top line.

↓ 234: Moves pointer to bottom of listing; auto scrolls to next page if pressed when pointer is on bottom line.

→236: Moves to next page; pointer location unchanged. Wraps to start of week listing when last page is displayed.

←238: Moves to previous page; pointer unchanged. Wraps to end of week if listing is already at start.

P 240: If not preceded by a numeric key, P will restrict listing to prime time only. If entered after a numeric key, P indicates PM.

A 242: If not preceded by a numeric key, A will restrict listing to selected themes only. If after a numeric key, A will indicate AM.

244: Advances to the next day, hour unchanged. Wraps around by days of the week.

MG Master Guide Mode

This mode allows direct selection of a program from the listing. For the average user, the Master Guide (MG) mode is the only mode used. To access the MG mode, press the MG key 222 once: to exit mode, press the MG key 222 a second time, or use the SEL key 228 if the pointer is positioned at the desired program.

The keyboard 220 may be used as a conventional TV selector by pressing the digit keys only, when the TV scheduler 160 is in the manual mode after the TV key is pressed. When used as a manual channel selector, each time that a new channel is selected, a channel number will appear on the bottom line of the screen. If a service name is associated with a signal received on a particular channel, the channel name will be displayed, rather than the channel number. Thus, if channel 3 is HBO, HBO will be displayed. Each time a channel is selected, a channel number or channel name, the name of the program, how long the program has been on, and how long remains for the program will appear on the bottom lines of the screen. For example, when the user scans the channel, it will show:

HBO	Prizzi's Honor	on for 55 minutes end in 35 minutes

Alternatively, the time that the show has been on and the time remaining could be shown graphically with, for example, a horizontal split bar graph. This approach can also be used when scanning program listings in the case of programs in progress at the time of the scanning.

The following is a typical screen when the MG key 222 is pressed. Listing always starts at the nearest previous half-hour. Note that the pointer always is positioned at the last selection made (Wall Street Week, in this example.)

9:00	Hotel series	Ch 7
	News	Ch 2
	Wall Street Week	Ch 17
	Movie	F2, Ch 20
9:15	Movie	HBO
9:30	Streets of SF	Ch 2
Wed. Jun 30, Prime: 6 pm 11 pm, theme 2 on		
Time: 9:23 PM Channel group 2 on Time remaining: 7min., Wall Street Week		

Note that screen will list 16 lines of program information not including the three status lines at the bottom of the screen. The time remaining could also be shown directly in the 16 lines of program information in the case of programs in progress. The designation "F2" is a satellite name. As shown, Prime indicates that the listing is restricted to hours between 6 pm and 11 pm. Theme 2 on indicates that theme group 2 is selected. Up to 4 groups of theme selection are available to accom-

modate 4 viewers. Channel group 2 restricts listing to channels defined under group 2. Four different channel groups are provided to accommodate different viewers. Up to 5 characters are available to indicate a program service by name.

Keys most commonly used in the MG mode. A complete detailed explanation follows:

UP 232, DOWN 234	moves pointer up or down
−> 236	moves one page forward
<− 238	moves one page backward
+ 244	moves one day forward, hour unchanged. Wraps around when last day of week is reached.
SEL 228	go to selected program (marked by pointer)
TV 226	go to conventional manual channel selection
Digits 246	used to set start time of search, else start of search will be at the nearest hour
Keys used by advanced users:	
C 230	Toggles channel listing restriction
P 240	Toggles prime time listing or sets PM
A 242	Toggles theme listing or sets AM

3. Detailed Operation in the MG mode When the MG key 222 is pressed, the TV screen will display a listing of programs starting at the nearest full hour. For example, if the time is 2:17, the display will start at 2:00. If desired, the user can enter the hour when the listing will start. For example, if 5 is entered, the listing will start at 5. Note that there is no need to enter an explicit AM or PM if the current AM or PM is same as the desired listing time. At the bottom of the screen is a two line status display, showing the actual time and date, and whether any of the search restrictions (prime, theme, and channel) are activated. If the prime is on, the prime time will limit the program listing to the prime time (specified by the user in the PG mode). If the start time is set to 6 pm, when the MG key 222 is pressed, the listing will start at 6 pm if the current time is 6 pm or earlier. If the current time is 9:05 pm, and the prime start time is 6 pm, then the listing will start at 9 pm, since a listing starting at 6 pm is not particularly useful.

Note that the user can override the prime time restriction by entering an hour digit at any time. The listing will immediately start at the override time. Also note that for the average user, the prime time need not be set. It is set to 6 pm to 11 pm by default when the Program Master is first used.

The cursor keys 232–236 can be used to select a different program. The up/down cursor keys 232–234 will move the cursor one line up or one line down at a time. When the top or the bottom of the listing is reached, the up key 234 will cause the screen to automatically display a previous one page, while the down key will cause the screen to display the next page.

To speed up listing, the left and right arrow page keys 238 and 236 may be used to go back or advance a page at a time, respectively. The cursor position is unchanged when the page keys 236–238 are used.

Once a desired program is indicated by the cursor, pressing the SEL key 228 will automatically cause the Program Master to return to the TV broadcast with the channel tuned to the selected program. The MG key 222 may also be used to return to the TV program, prior to selection in the MG mode. If the TV key 226 is pressed, the TV will return to the last manually selected program. By toggling between the MG and the TV modes, it is possible to review two programs without having to remember the channel numbers.

Example of MG Mode

To start listing at 2 pm, press the following keys:
MG 222, 2 digit key 246, P 240, SEL 228

The TV will immediately display the program next to the pointer when the SEL key 228 is pressed.

Pressing the P key 240 is optional; if omitted, the listing will be the same as the current PM or AM.

4. Program Guide (PG) Modes

For advanced users, the Program Master can be set up to list only the types of program (theme), only certain channels and only programs within a certain time, such as Prime Time. In addition, the Program Master can store weekly programs and special programs. The stored program can be used to trigger an alarm or enable a VCR without user intervention. The PG mode may be used for unattended recording of a series of programs by only menu selection, without the user having to set the VCR with channel, time, date, or length of program.

Note that the Program Master can be used without setting up any of these features. However, much of the power of the Program Master is contained in these features The PG modes are infrequently used by the average user. For advanced users, the PG modes may be re-programmed daily.

There are five sub-modes available when the PG key 224 is pressed. Each of these modes allows the user to customize the program listing. When the PG key 224 is first pressed, the following information is displayed at the bottom of the screen:

PG A	selects the theme setup mode
PG P	selects the prime time hours setup mode
PG C	selects the restrict channel listing setup mode
PG +	selects the weekly/special selection setup mode

PG A Theme Setup

When the A key 242 is pressed, a list of themes appears on the screen. The Up/Down keys 232–234 may be used to position the selection cursor next to the theme to be added to the list. The SEL key 228 is used to add to the list while the C key 230 can be used to cancel a selected theme. As each theme is selected, the cursor is enhanced by a marker identifying the themes selected. There can be up to 31 themes displayed on two pages.

Some themes, such as sports, have up to 15 subthemes Whenever the cursor is placed alongside a theme with sub-categories, an expanded listing appears on the right of the screen. These sub-themes may be accessed using the two left/right arrow keys 238 and 236 (used for page selection in the MG mode). When the right arrow key 236 is pressed the cursor will reposition to the top of the sub-themes. One or more subthemes can be selected using the SEL key 228 or eliminated using the C key 230. To return to the main themes, the left arrow key 238 is pressed. Alternatively, by pressing the MG key 222, the MG mode can be accessed directly. The selection made while in the PG A mode will be permanently stored.

The PG key 224 is generally ignored while in the PG mode. However, while in the sub-theme listing, the PG key 224 will return to the main theme listing. A typical theme listing is shown:

News	Football
Movies	Baseball
Sports (2) <	*Basketball
Childrens Show	Golf
Education and Science	Tennis
Financial News	Bowling
*Special Series (4)	*Racing
Travel	Boating
Foreign Language	Hunting
Game Show	Special Events
*Re-runs (ALL)	
Music	

Theme Group 2 Total no. of themes: 3
Total no of groups setup: 3

To accommodate several viewers with different theme interests, the Program Master has the facility to create up to four theme lists. To create a multiple list, after PG A is entered, enter a digit (from 1 to 4) immediately. To create another list, the user must exit the PG mode and re-enter PG A with a new digit. Note that when the user creates a numbered list, the Program Master still provides a default mode where all programs are listed (theme off mode). If no numbered list is created, the Program Master provides only two modes: theme off and theme on. Again, for the average user, this is the most common setup of the theme mode.

When the MG mode screen is displayed, the theme indicator at the bottom of the screen will list the current theme number if a numbered theme list exists. Each time the A key 242 is pressed, the theme number advances to the next theme number. For example, if there are two lists, theme 2 and theme 4, each time the A key 242 is pressed, the display shows theme 2, then theme 4, then no theme (theme off), and then back to theme 2.

The Program Master will remember the last theme setting when the Program Master is turned off, and will automatically be set to this mode when the MG key 222 is pressed.

Next to each main theme with selected sub-themes is a number indicating the number of sub-themes selected. If no sub-theme is selected, the Program Master assumes that all the sub-themes are to be displayed. In this case, the indicator will be ALL.

A sub-theme can be deleted using the C (cancel) key 230 with the cursor pointed at the sub-theme. It is possible to cancel all sub-themes by simply cancelling the main thex:e, using the same cursor key 232–234/C key 230 procedure.

The status lines give a summary of themes selected. Note that since the themes are listed on two pages, the summary gives the user some indication of activity of the second page.

PG P Prime Time Setup

This feature allows the user to set up the prime time schedule for restricting the listing to only programs falling within the prime time. When the MG mode is accessed, at the bottom of the screen is a status line indicating if the prime time only listing is on or off. By default, if the user does not set the prime time, the prime time is automatically set to 6 pm and 11 pm. There is only one prime time schedule for all viewers.

Enter start time: ___ (hour and A or P)
Enter end time: ___
Current Prime Time is set to: 7 pm - 1 am
Press MG, PG again, or TV to exit this mode
Only the MG key will cause the prime time to be modified

To enter the start and end time, the user keys in a digit key 246 followed by the A key 240 or the P key 242, indicating AM or PM. If no change is required of the start time, the user can skip to the end time by pressing the SEL key 228. Pressing the SEL key 228 twice will automatically exit the display back to the MG mode.

After a new time has been set, the current prime time on the status line will be changed the next time the user accesses the Prime Time mode. Pressing the TV key 226 or the PG key 224 will inhibit updating of the prime time. Only the MG key 222 will cause the prime time to be modified and stored.

Prime time, when activated, will restrict listing to the specified hours. In addition, if the current time is inside the prime time, the start of listing will be the nearest hour of the current time. For example, if the prime time is set from 7 pm to 11 pm, and the current time is 9:34, then the listing will start at 9:00 pm.

If the day command (+ key 244) is activated, the listing for the next day will always start at the beginning of prime time (7 pm in the above example) for the next day.

When the last hour specified by prime time is reached, the listing will wrap back to the start of prime time and will not advance to the next day.

PG C Channel Restriction List Setup This feature allows the user to restrict listing to the channels of interest, and also the satellite if it is a satellite broadcast. As in the case of themes, up to four different channel groups can be set up to accommodate different viewers. Alternatively, one of the list can be set up for just one or two channels of interest. To create a simple list, enter PG C. The following screen will appear;

A. Enter channels or satellite name/symbol to be listed: _____
B. Enter channels or satellite name/symbol not to be listed: _____
Note that only one of the above is allowed.
Changing from one to another will automatically delete channels of the other list.
Current channels listed: 2, 4, 5, 6, 7, 8, 9, 12, 22
Press MG, PG again, or TV to exit this mode.
Only MG will cause the changes to be updated.

To enter channels, press the digit keys 246 and enter using the SEL key 228. All single digit channels must be preceded by O. A channel can be removed from the list by using the paging keys 236–238 to position a marker under the channel number to be deleted under the channel number or channel name to be deleted. Similarly, if satellite listing service is requested, satellite names will be listed. Satellites, as well as channels, can also be deleted from the listing using the C key 230. The C key 230 will activate the deletion. Each time a channel is deleted, the marker will advance to the next position to the right of the deleted channel.

When the channel selections are completed, the MG key 222 must be entered to store the changes. When the

PG C mode is accessed again, the current channel listing will reflect the new changes.

Note that in many cases, the channel not to be listed is a much shorter list and therefore preferred over the to be listed list. The status line will indicate either the channels listed or channels not listed as entered by the user.

To create multiple lists, follow the PG C entry with a number from 1 to 4. Any other number will display a help screen. When MG is entered, the status will show Channel Group n instead of simply Channel ON or OFF for a single restriction list. There is always a default channel mode where all channels are listed. While in the MG mode, each time the C key is pressed, the Channel Group number is changed. If there are no more Group numbers, then the default channel mode is displayed.

PG+Schedule Setup

This mode allows the user to create a weekly reminder calendar, typically for weekly series and special events of non-weekly programs. The reminder process will set an alarm if the TV is not on before a certain time before the start of the program. If the TV is not on when the program starts, the reminder process will turn on the VCR to start recording the program.

The schedule may be programmed to respond to either a single program of a series or all programs of a series. For example, a daily or weekly show may be scheduled for a particular day or for all occurrences in the program listing.

The Program Master will automatically link and schedule all programs of a series using a linking code assigned to all programs of a series by the broadcaster. For example, the NBA playoff series which occurs at an irregular time and interval may be completely scheduled just by selecting the NBA listing and assigning an ALL suffix to the listing. At the end of the series, the listing is automatically revised with the suffix, OLD. After one week, the listing will automatically be deleted, if the user has not already deleted it. If a program selection is not followed by the A key 242, the program is assumed to be one time only. The A key 242 can be pressed at any time to affect ALL responses.

When the schedule mode is entered, a split screen displays the scheduled program on the top eight lines and the program list on the bottom eight lines. This listing is identical to the MG listing, except that a shortened listing is displayed instead of 16. All other MG parameters, such as Prime, Channel, and Theme are in effect. The user should review the MG status before setting up the schedule. Up to 16 programs can be entered in the schedule listing using two pages of display. The page keys 232 and 234 are used to access the second page. Either the up or down keys 232 and 234 will toggle the schedule listing.

A typical schedule is shown below:

Hotel (ALL)		Fri 9 pm	ch 7
Dynasty (ALL)		Wed 8:30 pm	ch 4
Simon and Simon (ONLY)		Mon. 10 pm	ch 2
7:30	News		ch 2
	Evening		ch 4
	Movie: Prizzi's Honor		SHO
	Movie: 2001		AD, ch 19
8:00	Masterpiece Theater		

Wed Jun 30 5:34 pm Schedule Page 1 (status line)
Use A to enter ALL; press A again to toggle back to ONLY

-continued

The cursor and page keys 232–238 operation is identical to the MG mode except the range is restricted to either the upper or lower half of the display. If the cursor points to the top of the program listing (line 9), the listing will scroll down a half page (eight lines). If the cursor points to the bottom of the schedule (line 8), the schedule will shift to the next page. To cross from schedule to program list, and vice versa, the P key is used. The cursor will reposition itself to the top of the new selection.

In the lower listing, the +key 244 operates as in the MG mode, advancing the listing by one day at a time. In the upper screen, the + key 244 has no effect.

To add a program to the schedule, use the P key 240 to toggle the cursor to the program listing (lower half of display). Use the cursor, page, or + keys 232–234, 236–238 or 244 to locate the desired program. Use the SEL key 228 to store the program in the schedule. The upper screen will immediately display the new addition. If the page is full, the Program Master will automatically switch to the next page. If both pages are full, the status line will show a FULL message.

To cancel a scheduled program, either to make a correction or make room for a new addition, use the P key 240 to switch to the upper display. Position the cursor to the program to be deleted, using the up/down or page keys 232–238. Press the C key 230 to cancel the program.

All changes to the schedule are effective upon pressing SEL or C, and do not require the MG key 222 to initiate update. To exit, use the MG or TV key 222 or 226.

During attended operation, when a scheduled program is activated, the name of the program will be superimposed onto the TV screen as a subtitle when the TV is first turned on. Pressing the TV key 226 will clear the subtitle. During an unattended operation, no name will be superimposed onto the screen, so that VCR recording will not be disturbed.

5. Flow Diagram Description

The following is a description of the program sequences for the CPU 110 in FIG. 3 or the CPU 178 in FIG. 4.

Received data from data demodulator 102, FIG. 3 or data demodulator 169, FIG. 4, is stored in temporary buffer 300 of FIG. 6. The buffer is enabled by the system clock 128, FIG. 3 or 194, FIG. 4 during down time of the broadcast. In another implementation, the buffer 300 is always enabled. The ID of the subscriber in ROM 112 of FIG. 3 or ROM 184 of FIG. 4 is compared with the received data, by decision block 301 of FIG. 6. If a match is found, the Program Master is ready to receive programming data. In another implementation, no ID match is required to receive the programming data.

As each block of data is received, the data integrity is verified by error checking logic at 302. If no error exists, the received data is stored in the program list buffer 303, replacing the previous program list data. If an error exists and is determined to be correctable at 304, the block is corrected at 305 and then stored in the program list buffer 303. The block error analysis 302 is based on cyclic redundancy coding to correct errors that affect short burst errors in a known manner.

If the error is determined to be uncorrectable, the number of the uncorrectable block is logged in an error log 306. The receiver is set by 307 in this case to wait for another complete transmission before terminating the program update. The microcomputer 22 of FIGS. 1 and 2 is programmed to repeat transmissions of the program list for a number of times to allow for correction of uncorrectable errors at the receiver 90 or 160 (FIGS. 3 and 4).

When the last decision block 308 detects a last block command in the transmission, update of the program listing is terminated. The CPU passes control at 309 to the command string processor 310, FIG. 7.

The command string 310 searches for closure of the MG key 222 (FIG. 5) at 320, the PG key 224 at 321, or the TV key 226 at 322. If any other keys are entered before one of these keys, the key is ignored. If the TV key 226 is entered, the manual TV channel select mode is set up at 323. The Program Guide then functions as a standard remote TV tuner.

When a channel is changed at 323, the channel number or name is inserted into the lower half of the screen for a few seconds. Video switcher 172 (FIG. 4) is controlled by line 210. When the TV frame reaches the bottom half of the screen, line 210 selects the video display generator 204 instead of the programmable TV tuner 164 as its input. The timing to actuate line 210 is derived from the program data timing controller 168 and is inputted to the CPU 178 by the data demodulator 169 output line 182. Other implementations are possible, such as insertion of the channel number or name into the video picture.

If the MG key 222 is entered, the MG mode is selected, FIG. 8. Upon entry, the system clock time and calendar is stored in the status line buffer 350. The set list pointer 351 is adjusted to the nearest hour based on the current time and date.

A search of the program listing 352 is made. The search is dependent on the status of the channel buffer, the theme buffer, the prime time buffer, and the direction of search. If the page 356 is up, the search direction is forward starting from the list pointer. If the page is down 357, the search direction will be backward 358 from the current list pointer. When the search satisfies the above criteria, the program listing is placed into the screen buffer 353. The search continues until the screen buffer is full 354 in which case the search is terminated. The status lines information is passed to the screen buffer and displayed 355 by the TV.

The CPU 110 (FIG. 3) or 178 (FIG. 5) selects the screen buffer to drive the video display generator 136 (FIG. 3) or 204 (FIG. 4), and also operates the video switcher 140 (FIG. 3) or 172 (FIG. 4) to switch the TV 126 (FIG. 3) or 200 (FIG. 4) from the programmable TV tuner 132 (FIG. 3) or 164 (FIG. 4) to the generator 136 or 204.

If a digit key 246 (FIG. 5) is detected at 360, the search time is changed to agree with the digit entered at 363. If the P or A key is detected at 362, the PM or AM of the time will be changed accordingly. The screen buffer is cleared at 364 and a new search is started with the list pointer set to the new search time.

If a + key 244 entry is detected at 365, the search date is incremented at 366, the screen buffer is cleared 364 and a new search is started with the list pointer set to the next day. The increment search date at 366 will return the start of listing date if incrementing will go beyond the last date of the programming listing.

If an SEL key entry is detected at 370, the channel of the programmable tuner 132 or 164 will be set to the channel listed at 375 at the current cursor position of the MG display. The MG mode is terminated at 376 and the TV 126 or 200 is switched by the video switcher 140 or 172 to the tuner 132 or 164.

If an MG key 222 entry is detected at 371, the MG mode is terminated at 176 and the TV 126 or 200 is switched to the channel that was set in the programmable tuner 132 or 164 before the MG mode was activated.

If a P, C or A key 240, 230 or 242 closure is detected at 373, the prime buffer, channel buffer and theme buffer are toggled off or on at 377. The screen buffer is cleared at 364, and a new search is commenced with one of the search criteria changed.

If a cursor key 232 or 234 closure is detected at 374, the screen cursor will be positioned up or down at 378 corresponding to the up or down cursor. The screen buffer is updated at 353 to reflect the new cursor position.

Referring to the flow diagram of FIG. 7, if closure of the PG key 224 is detected at 321, followed by closure of the A key 242 at 324, the theme mode is selected. Referring to FIG. 9, the theme buffer 400 is selected by the CPU 110 or 178 to output to the video generator 136 or 204 and displayed on the TV 126 or 200, as indicated at 401. The theme buffer data originates from the received program list data. The themes may change over time as new themes are presented. The status line information is also displayed on the TV 126 or 200, as indicated at 402. The status line indicates the current PG mode, theme, time, date and also shows the number of selected themes.

If a cursor key 232–234 closure is detected at 403, the cursor position is moved up or down one listing at 409 and the display is updated at 401. If an SEL key 228 closure is detected at 404, the listing pointed by the cursor is annotated at 410 and displayed as an asterisk next to the listing.

If a C key 230 closure is detected at 405, any annotated theme pointed to by the cursor is deleted at 411. If the theme is not annotated, the C key 230 is ignored.

Each time a theme is selected or deleted, the number of themes selected is determined and the status line updated at 402 to reflect the current status.

If entry of the digits 1, 2, 3 or 4 keys 246 is detected at 406, a new theme buffer is selected at 412 and displayed at 401.

If an MG key 222 closure is detected at 407, the screen is cleared and replaced by the MG mode, FIG. 7. If a TV key 226 closure is detected at 408, the display is replaced by the TV program selected by the programmable tuner 132 or 164 prior to the theme mode.

If a key is detected other than any of the above, an error message is placed in the status line field at 413 indicating the keys allowed.

Prime

Referring to FIG. 7, if a P key closure is detected at 325, the prime time mode is selected. Referring to the prime time flow chart, FIG. 10, the prime time buffer is selected and displayed at 420. The status information for the prime mode is also displayed at 421.

The prime time entry mode is set up to input the start time at 422. If a digit key 246 is detected at 423, followed by either the A or P key 242 or 240, indicating AM or PM respectively, the digit and am or pm is stored at 428 in the prime screen buffer. If neither A or

P is detected, the SEL decision block 424 determines whether the SEL key 228 has been entered. If the SEL key 228 is detected, the prime screen buffer will accept the digit and store it at 428 with an implied am or pm based on the previous am or pm selection.

When an input is accepted, the entry mode changes from the start time to the end time at 429. The end entry sequence is the same as the start, except when the screen is updated, the prime mode exits to the MG display. The new prime time is now displayed on the MG status line.

If none of SEL, A or P 228, 242, 240 are detected at 424, and the key closure is not MG 222 or TV 226, as detected at 426 and 427, then a prime mode error message is displayed at 430. The message is inserted into the status line indicating the valid keys that can be entered.

If the MG or TV key 222 or 226 is detected, the result is the same as for the theme mode.

Channel

Referring to the command string flow diagram, FIG. 7, the channel mode is selected if the C key 230 is detected at 326. Referring to the channel flow diagram, FIG. 11, the channel screen buffer 450 is selected by the CPU 110 or 178 to be displayed at 451 on the TV 126 or 200.

Status information for the channel mode is displayed at 452 with the channel information. If the cursor keys 232–234 are detected at 453, the entry list switches from channels to be displayed to channels not to be displayed at 459.

If a digit key 246 is detected at 454, the CPU 110 or 178 waits for an SEL key 228 entry at 460 to enter the data into the channel screen buffer at 461.

If a page key 236–238 is detected at 455, an underline marker will be positioned under the first channel number entry at 462. If the following key is a C (cancel) key 230, detected at 463, the underlined channel will be deleted from the channel screen buffer at 464. If it is not a C key 230, the CPU 110 or 178 will wait for another key at 455. If another page key 236–238 is entered, the underline will move to the next channel number listed at 462. Thus the page keys 236–238 may be used to point at a channel to be deleted.

If an invalid key is entered (none of the above keys, MG 222 or TV 226, tested at 456 and 457 respectively), an error message for the channel mode will be displayed on the status line at 458 indicating the required valid keys.

Referring again to the command string flow diagram, FIG. 7, if the + key 244 is detected at 327, the schedule mode is selected. Referring to the schedule flow diagram, FIG. 12, the CPU 110 or 178 selects the schedule screen buffer to be displayed on TV 126 or 200 when the schedule mode is enabled. The schedule is presented on the upper half of the screen at 480.

The program listing is presented on the lower half of the screen at 481. The remaining time for each listed program is computed by referencing against the current time and the length of program time. If the P key 240 is detected at 482, the cursor moves from the listing section to the schedule section of the screen. The P key 240 is used to toggle the cursor between the two sections at 488.

If a cursor key 232–234 is detected at 483, the cursor will be positioned at 489 a line at a time as in the MG display. However, instead of causing the screen to scroll when the cursor reaches the bottom of the screen, scrolling starts when the cursor attempts to cross the middle of the screen, that is, cross into the other section of the display.

If a page key 236–238 is detected at 483, the section with the cursor will scroll at 489 forward or backward depending on the page direction.

If the SEL key 228 is detected at 484, and if the cursor is located in the program list section at 490, the listing pointed to by the cursor will be computed for non-conflict with existing listing. If the desired new listing schedule overlaps or conflicts with the existing listing, a warning message will appear in the status line field. The user is required to enter the SEL key 228 a second time to update the schedule. If the warning message is ignored, the latter entry will not be supported for purposes of unattended VCR operation. Thus, the user is informed of a possible error before unattended recording is started.

When the SEL key 228 is entered, the selected list is copied to the end of the schedule section at 491. If the schedule section is full, the status line will indicate that a schedule listing must be deleted to make room for the new listing. When a list is changed, the display is updated at 480.

If the C key 230 is detected at 485, and if the cursor is located in the schedule list section, determined at 492, the listing pointed to by the cursor will be removed at 493 and the remaining listings will be shifted forward by one listing to fill the gap left by the deleted listing.

If the key is MG 222 or TV 226, as determined at 486 and 487 the result is the same as for the theme mode discussed above.

If an invalid key is entered, a schedule error message will appear in the status line at 494.

Finally in the command string flow diagram, FIG. 7, if a key closure other than the above keys described for steps 324–327 is detected, a PG error message will be generated at 328.

Alarm and Unattended Recording

Referring to the alarm flow chart, FIG. 13, a schedule search is made once a minute at 500. If the system clock time is within the schedule time at 501, the TV set 126 or 200 is tested to see if it is on or off at 502. If the TV 126 or 200 is on, a sub-title showing the name of the scheduled list that produced the alarm will be displayed at 508. If the TV key 226 is detected at 509, the sub-title will be deleted at 510. If the TV key 226 is not detected when the scheduled program is active, the alarm 156 or 217 will be sounded at 511.

If the TV 126 or 200 is not on at 502, the alarm 156 or 217 will be sounded five minutes before the start of the scheduled program at 503. If the TV is still not on at 504, the programmable tuner 132 of FIG. 3 or 164 of FIG. 4 will be set to the scheduled program at 505. The VCR 150 or 216 will be turned on by a signal on line 154 or line 218, respectively, to record the program at 506. At the end of the program at 507, a new search is commenced at 500.

For unattended recording with the TV scheduler 160 of FIG. 4B, turn on of the remote VCR 216 is accomplished by means of the remote controller 1010 connected to the TV scheduler 160. Turn-on, record and turn-off are all actuated remotely as described above in connection with FIG. 4B.

Broadcast Format

Each program listing is framed with the following information;

Start time	hour, minute
Duration of program	hour, minutes
Channel number	two digits
Theme classification number	two digits
Theme subclassification number	two digits
Linking number (only for serial shows)	three digits
Optional expanded listing	text up to 300 characters
End of Program	single character
Satellite symbol	two characters
Satellite name	five characters
Encrypted and any special broadcast indicators	one character

Program listings are contained within a variable length data block of about 1,000 bytes. Each block includes CRC codes to allow correction of short burst errors of up to six characters.

The systems shown in FIGS. 1–4 are preferably implemented with the commercially available subsystems shown in the following table.

Reference Nos.	Subsystem	Source
22	IBM PC/AT	IBM Corporation, Boca Raton, Florida
26, 102, 169	Hayes Smartmodem 1200	Hayes Microcomputer Products, Norcross Georgia
106, 180	Little Board/186 Microcomputer	Ampro Computers, Inc. Mountain View, California
116, 188	Remote Control Transmitter Model SDA 2208-2	Siemens Iselin, N.J.
118, 190	Remote Control Receiver Model SAB 4209	Siemens
126, 200	Sony KV-2670R with auxilliary input	Sony Corp. New York, N.Y.
132, 164	Programmable Tuner SA 210	Siemens
98	Quotrex FM/SCA Receiver	Data Speed, San Mateo, California
136, 204	Motorola CRT Controller MC6845	Motorola, Inc. Austin, Texas
1010, 1020	JVC Model RM-P67U Wireless Remote Control	JVC Co. of America Elmwood Park, N.J.

It should now be readily apparent to those skilled in the art that a novel electronic system and process for controlling a television receiver to allow user selection of broadcast programs from schedule information capable of achieving the stated objects of the invention has been provided. The system and process of this invention allows the user to supply selection criteria to the system and in the process that can be combined to search a substantial quantity of schedule information received as a broadcast or otherwise supplied to the system to choose programs meeting the selection criteria. The system and process of this invention will determine if the viewer's television set is turned on at the time of a selected broadcast program, and will automatically record the selected program on a VCR or other program recording device if the television set is not turned on.

It should further be apparent to those skilled in the art that various changes in form and details of the invention as shown and described may be made. For example, the schedule information could be accessible with a personal computer through an information utility, such as Compuserve or The Source, and the user could either make the selection inputs to the utility's mainframe for running a selection program on the mainframe and then download the selected program information, or download the program schedule information for his or her locality, then run the selection program with the downloaded program schedule information on the personal computer. The television set and VCR could then be controlled as peripherals of the personal computer. Alternatively, the user could employ the selected program information from the personal computer to control the television receiver or VCR manually in the process of this invention. A diskette containing broadcast information could be used instead of a direct broadcast as an input to the TV soheduler. The diskette can be read by a computer that controls a programmable TV tuner. The TV scheduler can be used to control a satellite programmable tuner as well as a TV programmable tuner. If the user selects a listing of a program that is broadcast by satellite, the scheduler will automatically set the satellite tuner, as well as the TV tuner, to correspond to the selected listing. It is intended that such changes be included within the spirit and scope of the claims appended hereto.

What is claimed is:

1. A system for controlling a television receiver to allow user selection of broadcast programs from schedule information, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information based on user inputs, storage means connected to receive the schedule information for programs selected by said data processor, and a programmable tuner for connection to the television receiver, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply broadcast signals for the selected program to the television receiver, said data processor being configured to supply an actuating signal to a program recorder at the time of a broadcast program selected by said data processor and to supply the broadcast signal for the selected program to said program recorder, said system being configured to allow said television receiver to receive a different program than the broadcast signal for the selected program supplied to said program recorder.

2. The system of claim 1 additionally comprising a video display generator connected to receive signals from said data processor for generating a video display from the schedule information and the user selections on the television receiver, and a video switcher connected to receive video display signals from said video display generator, broadcast program signals from said programmable tuner and control signals from said data processor for selecting between the video display signals and the broadcast program signals for supplying to the television receiver.

3. The system of claim 2 in which said data processor and said video display generator are further configured to display names of program services in the schedule information.

4. The system of claim 2 in which said data processor and said video display generator are further configured

to present a preselected portion of the schedule information for the user selection.

5. The system of claim 1 in which the schedule information is also broadcast and said first input means comprises a broadcast signal receiver connected to supply the broadcast schedule information to said data processor.

6. The system of claim 5 in which said broadcast signal receiver is a frequency modulation receiver configured to receive the broadcast schedule information independently of the broadcast programs, said first input means includes a data demodulator connected to supply the schedule information to said data processor, said frequency modulation receiver being connected to supply the broadcast schedule information to said data demodulator.

7. The system of claim 5 in which the schedule information is broadcast in an otherwise unused portion of a television program broadcast, said programmable tuner includes said broadcast signal receiver, said first input means includes a data demodulator connected to supply the schedule information to said data processor, and said programmable tuner is connected to supply the schedule information portion of the television program broadcast to said data demodulator.

8. The system of claim 1 in which said data processor is further configured to supply an actuating signal to a program recorder at the time of a broadcast program selected by said data processor and to supply the broadcast signal for the selected program to said program recorder.

9. The system of claim 1 additionally comprising a video display generator connected to receive signals from said data processor for generating a video display from the schedule information and the user selections on the television receiver, and a video switcher connected to receive video display signals from said video display generator, broadcast program signals from said programmable tuner and control signals from said data processor for selecting between the video display signals and the broadcast program signals for supplying to the television receiver, and in which the schedule information is also broadcast and said first input means comprises a broadcast signal receiver connected to supply the broadcast schedule information to said data processor.

10. The system of claim 9 in which said data processor is further configured to provide signals to said video display generator for presenting a plurality of user selection menus on the television receiver, and said second user selection input means includes a plurality of keys for making selections from the menus for choosing programs from the schedule information.

11. The system of claim 1 in which said programmable tuner receives both the schedule information and the broadcast signals for the selected programs, said programmable tuner being connected as part of said first input means.

12. A system for controlling a television receiver to allow user selection of broadcast programs from schedule information, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information based on user inputs, storage means connected to receive the schedule information for programs selected by said data processor, and a programmable tuner for connection to the television receiver, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply broadcast signals for the selected programs to the television receiver, said data processor being configured to provide signals to said video display generator for presenting a plurality of user selection menus on the television receiver, and said second user selection input means includes a plurality of keys for making selections from the menus for choosing programs from the schedule information, said data processor being configured to allow combinations of the menu selections for choosing programs from the schedule information.

13. A system for controlling a television receiver to allow user selection of broadcast programs from schedule information, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information based on user inputs, storage means connected to receive the schedule information for programs selected by said data processor, and a programmable tuner for connection to the television receiver, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply broadcast signals for the selected programs to the television receiver, said data processor being configured to supply an actuating signal to a program recorder at the time of a broadcast program selected by said data processor and to supply the broadcast signal for the selected program to said program recorder, said data processor being configured to receive an input signal for determining whether the television receiver is operating at the time of the broadcast program selected by said data processor and to supply the actuating signal to said program recorder unless the television receiver is operating.

14. A system for controlling a television receiver to allow user selection of broadcast programs from schedule information, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information based on user inputs, storage means connected to receive the schedule information for programs selected by said data processor, and a programmable tuner for connection to the television receiver, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply broadcast signals for the selected programs to the television receiver, said data processor being configured to supply an actuating signal to a program recorder at the time of a broadcast program selected by said data processor, said data processor being connected to a remote controller for said program recorder to supply control signals to said remote controller for recording of the selected program.

15. A system for controlling a television receiver to allow user selection of broadcast programs from schedule information, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection

input means connected to said data processor, said data processor being configured to select programs from the schedule information based on user inputs, storage means connected to receive the schedule information for programs selected by said data processor, and a programmable tuner for connection to the television receiver, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply broadcast signals for the selected programs to the television receiver, said data processor being configured to supply an actuating signal to a program recorder at the time of a broadcast program selected by said data processor and to supply the broadcast signal for the selected program to said program recorder, the broadcast signals including end of program information for at least programs of uncertain duration, and said data processor being configured to terminate recording by the program recorder in response to the end of program information.

16. A system for controlling a television receiver to allow user selection of broadcast programs from schedule information, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information based on user inputs, storage means connected to receive the schedule information for programs selected by said data processor, and a programmable tuner for connection to the television receiver, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply broadcast signals for the selected programs to the television receiver, the schedule information including linking information to identify multiple programs of a single series and said data processor being configured to select the multiple programs of the single series on the basis of the linking information in response to user selection of one of the programs in the single series.

17. A system for controlling a television receiver to allow user selection of broadcast programs from schedule information, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information based on user inputs, storage means connected to receive the schedule information for programs selected by said data processor, and a programmable tuner for connection to the television receiver, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply broadcast signals for the selected programs to the television receiver, said data processor being configured to receive an input signal for determining whether the television receiver is operating prior to the time of a broadcast program selected by said data processor, said system further comprising an alarm connected to receive an actuating signal from said data processor, and said data processor being configured to provide the actuating signal to said alarm unless the television receiver is operating when said data processor checks the television receiver for operation.

18. A process for controlling the presentation of broadcast programs to a television receiver, which comprises supplying program schedule information to a data processor, supplying user program selection criteria to the data processor, combining user selection criteria, selecting those programs meeting the combined user selection criteria for viewing from the program schedule information in the data processor, storing information identifying the selected programs, and using the stored information to tune the television receiver to the selected programs.

19. The process of claim 18 in which the television receiver is used as a display by the data processor for presenting messages to the user during the process.

20. The process of claim 19 in which names of program services are displayed in the schedule information.

21. The process of claim 19 in which only a preselected portion of the schedule information is presented for the user selection.

22. The process of claim 18 in which at least some of the user selection criteria are supplied to the data processor by presenting a menu from the data processor on a display and allowing the user to select an item from the menu.

23. The process of claim 18 further comprising the steps of checking for a conflict between a selected program and a previously selected program and providing an indication to the user of such conflict.

24. The process of claim 18 in which the program schedule information is supplied to the data processor by broadcast.

25. The process of claim 24 in which the program schedule information is supplied as a separate broadcast from the program broadcasts.

26. The process of claim 24 in which the television receiver is used as a display by the data processor for presenting messages to the user during the process.

27. The process of claim 26 in which at least some of the user selection criteria are supplied to the data processor by presenting a menu from the data processor on a display and allowing the user to select an item from the menu.

28. The process of claim 27 further comprising the steps of checking for a conflict between a selected program and a previously selected program and providing an indication to the user of such conflict.

29. The process of claim 28 further including the steps of providing linking information to identify multiple programs of a single series and selecting the multiple programs of the single series on the basis of the linking information in response to user selection of one of the programs in the single series.

30. The process of claim 29 additionally comprising the steps of using the data processor to turn on a broadcast program recording device for a selected broadcast program and recording the selected broadcast program on the program recording device.

31. The process of claim 24 in which the program schedule information and the programs are broadcast together, the process additionally comprising the step of separating the program schedule information from the programs for supplying the program schedule information to the data processor.

32. A process for controlling the presentation of broadcast programs to a television receiver, which comprises supplying program schedule information to a data processor, supplying user program selection criteria to the data processor, using the user selection criteria

to select programs for viewing from the program schedule information in the data processor, storing information identifying the selected programs, using the stored information to tune the television receiver to the selected programs, using the television receiver as a display by the data processor for presenting messages to the user during the process, including time remaining for a program being broadcast.

33. A process for controlling the presentation of broadcast programs to a television receiver, which comprises supplying program schedule information to a data processor, supplying user program selection criteria to the data processor, using the user selection criteria to select programs for viewing from the program schedule information in the data processor, storing information identifying the selected programs, using the stored information to tune the television receiver to the selected programs, turning on a broadcast program recording device for a selected broadcast program, recording the selected broadcast program, and supplying a different program broadcast signal to the television receiver than the broadcast signal for the selected program supplied to the program recording device.

34. A process for controlling the presentation of broadcast programs to a television receiver, which comprises supplying program schedule information to a data processor, supplying user program selection criteria to the data processor, using the user selection criteria to select programs for viewing from the program schedule information in the data processor, storing information identifying the selected programs, using the stored information to tune the television receiver to the selected programs, turning on a broadcast program recording device for a selected broadcast program, recording the selected broadcast program, broadcasting end of program information for at least programs of uncertain duration, and terminating recording by the program recording device in response to the end of program information.

35. A process for controlling the presentation of broadcast programs to a television receiver, which comprises supplying program schedule information to a data processor, supplying user program selection criteria to the data processor, using the user selection criteria to select programs for viewing from the program schedule information in the data processor, storing information identifying the selected programs, using the stored information to tune the television receiver to the selected programs, turning on a broadcast program recording device for a selected broadcast program, recording the selected broadcast program, determining whether the television receiver is operating at the time of the selected broadcast program and turning on the recording device and recording the selected broadcast program unless the television receiver is operating.

36. A process for controlling the presentation of broadcast programs to a television receiver, which comprises supplying program schedule information to a data processor, supplying user program selection criteria to the data processor, using the user selection criteria to select programs for viewing from the program schedule information in the data processor, storing information identifying the selected programs, using the stored information to tune the television receiver to the selected programs, turning on the program recording device, and recording the selected program by supplying control signals to a remote controller for the program recording device.

37. A process for controlling the presentation of broadcast programs to a television receiver, which comprises supplying program schedule information to a data processor, supplying user program selection criteria to the data processor, using the user selection criteria to select programs for viewing from the program schedule information in the data processor, storing information identifying the selected programs, using the stored information to tune the television receiver to the selected programs, providing linking information to identify multiple programs of a single series and selecting the multiple programs of the single series on the basis of the linking information in response to user selection of one of the programs in the single series.

38. A process for controlling the presentation of broadcast programs to a television receiver, which comprises supplying program schedule information to a data processor, supplying user program selection criteria to the data processor, using the user selection criteria to select programs for viewing from the program schedule information in the data processor, storing information identifying the selected programs, using the stored information to tune the television receiver to the selected programs, determining whether the television receiver is operating prior to the time of a broadcast program selected by the process and providing an alarm signal to the user unless the television receiver is operating when the television receiver is checked for operation.

39. A system for controlling a television receiver to allow user selection of broadcast programs from schedule information, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information based on user inputs, storage means connected to receive the schedule information for programs selected by said data processor, and a programmable tuner for connection to the television receiver, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply broadcast signals for the selected programs to the television receiver, a video display generator connected to receive signals from said data processor for generating a video display from the schedule information and the user selections on the television receiver, and a video switcher connected to receive video display signals from said video display generator, broadcast program signals from said programmable tuner and control signals from said data processor for selecting between the video display signals and the broadcast program signals for supplying to the television receiver, the schedule information also being broadcast, said first input means comprising a broadcast signal receiver connected to supply the broadcast schedule information to said data processor, said data processor being configured to provide signals to said video display generator for presenting a plurality of user selection menus on the television receiver, said second user selection input means including a plurality of keys for making selections from the menus for choosing programs from the schedule information, said data processor being configured to allow combinations of the menu selections for choosing programs from the schedule information.

40. The system of claim 39 in which the schedule information includes linking information to identify multiple programs of a single series and said data processor is further configured to select the multiple programs of the single series on the basis of the linking information in response to user selection of one of the programs in the single series.

41. The system of claim 40 in which said data processor is further configured to supply an actuating signal to a program recorder at the time of a broadcast program selected by said data processor.

42. A system for controlling a recording device to allow user selection of broadcast programs from schedule information, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information based on user inputs, storage means connected to receive the schedule information for programs selected by said data processor, a programmable tuner for connection to the recording device, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply broadcast signals for the selected programs to the recording device, and a television receiver, said system being configured to allow said television receiver to receive a different program than the broadcast signal for the selected program supplied to said recording device.

43. The system of claim 42 additionally comprising a display means connected to receive signals from said data processor for generating a display from the schedule information and the user selections on said display means.

44. The system of claim 43 in which said data processor and said display means are further configured to present a preselected portion of the schedule information for the user selection.

45. The system of claim 43 in which the schedule information is broadcast and said first input means comprises a broadcast signal receiver connected to supply the broadcast schedule information to said data processor.

46. The system of claim 45 in which said broadcast signal receiver is a frequency modulation receiver configured to receive the broadcast schedule information independently of the broadcast programs, said first input means includes a data demodulator connected to supply the schedule information to said data processor, said frequency modulation receiver being connected to supply the broadcast schedule information to said data demodulator.

47. The system of claim 45 additionally comprising a television receiver, and in which the schedule information is broadcast in an otherwise unused portion of a television program broadcast, said programmable tuner includes said broadcast signal receiver, said first input means includes a data demodulator connected to supply the schedule information to said data processor, and said programmable tuner is connected to supply the schedule information portion of the television program broadcast to said data demodulator.

48. The system of claim 43 in which said data processor is further configured to provide signals to said display means for presenting a plurality of user selection menus on said display means and said second user selection input means includes a plurality of keys for making selections from the menus for choosing programs from the schedule information.

49. The system of claim 48 in which said data processor is further configured to allow combinations of the menu selections for choosing programs from the schedule information.

50. The system of claim 42 in which said programmable tuner receives both the schedule information and the broadcast signals for the selected programs, said programmable tuner being connected as part of said first input means.

51. A system for controlling a recording device to allow user selection of broadcast programs from schedule information, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information based on user inputs, storage means connected to receive the schedule information for programs selected by said data processor, a programmable tuner for connection to the recording device, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply broadcast signals for the selected programs to the recording device, said data processor being connected to a remote controller for said recording device to supply control signals to said remote controller for powering on said recording device, starting and stopping recording of the selected program and powering off said recording device.

52. A system for controlling a recording device to allow user selection of broadcast programs from schedule information, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information based on user inputs, storage means connected to receive the schedule information for programs selected by said data processor, a programmable tuner for connection to the recording device, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply broadcast signals for the selected programs to the recording device, the broadcast signals including end of program information for at least programs of uncertain duration, and said data processor being configured to terminate recording by the recording device in response to the end of program information.

53. A system for controlling a recording device to allow user selection of broadcast programs from schedule information, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information based on user inputs, storage means connected to receive the schedule information for programs selected by said data processor, a programmable tuner for connection to the recording device, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable

tuner to supply broadcast signals for the selected programs to the recording device, the schedule information including linking information to identify multiple programs of a single series and said data processor being configured to select the multiple programs of the single series on the basis of the linking information in response to user selection of one of the programs in the single series.

54. A system for controlling receipt of broadcast television programs to allow user selection of broadcast programs from broadcast schedule information, which comprises a data processor, a programmable tuner configured to receive both the broadcast programs and the broadcast schedule information connected to said data processor, means connected between said programmable tuner and said data processor for separating the broadcast schedule information from the broadcast programs and supplying the broadcast schedule information to said data processor, a user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information based on user inputs, storage means connected to receive the schedule information for programs selected by said data processor, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply signals for the selected broadcast programs to at least one signal receiver for the selected broadcast programs.

55. The system for controlling receipt of broadcast television programs of claim 54 in which said at least one signal receiver comprises a recording device.

56. The system for controlling receipt of broadcast television signals of claim 55 in which said at least one signal receiver additionally comprises a television, and said system additionally comprises a means for switching between said recording device and said television for receiving the signals for the selected broadcast programs.

* * * * *

US004706121B1

REEXAMINATION CERTIFICATE (2148th)

United States Patent [19]

Young

[11] B1 4,706,121

[45] Certificate Issued Dec. 14, 1993

[54] **TV SCHEDULE SYSTEM AND PROCESS**

[75] Inventor: **Patrick Young**, San Mateo, Calif.

[73] Assignee: **Insight Telecast, Inc.**, San Mateo, Calif.

Reexamination Request:
No. 90/002,537, Dec. 6, 1991

Reexamination Certificate for:

Patent No.:	4,706,121
Issued:	Nov. 10, 1987
Appl. No.:	860,077
Filed:	May 6, 1986

[51] **Int. Cl.**[5] H04N 7/08; H04N 7/093

[52] **U.S. Cl.** 358/142; 358/146; 358/147; 358/335; 340/825.22; 360/33.1; 369/19; 455/151.4; 455/181.2; 455/186.4; 968/977; 968/DIG. 1

[58] **Field of Search** 358/147, 146, 142, 141, 358/335, 189, 84, 85, 86, 191.1; 455/151.4, 181.2, 186.2; 360/33.1

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,031,548	6/1977	Kato et al. .	
4,081,753	3/1978	Miller .	
4,170,782	10/1979	Miller .	
4,305,101	12/1981	Yarbrough et al. .	
4,329,684	5/1982	Monteath et al.	235/472
4,381,522	4/1983	Lambert .	
4,388,179	6/1983	Kruger et al. .	
4,390,901	6/1983	Keiser	358/147
4,598,288	7/1986	Yarbrough et al. .	
4,635,121	1/1987	Hoffman et al.	358/188
4,641,205	2/1987	Beyers, Jr. .	
4,689,022	8/1987	Peers et al. .	
4,712,105	12/1987	Kohler .	
4,751,578	6/1988	Reiter et al. .	
4,754,326	6/1988	Kram et al. .	
4,787,063	11/1988	Muguet .	
4,908,713	3/1990	Levine .	
4,963,994	10/1990	Levine .	

FOREIGN PATENT DOCUMENTS

3337204	4/1985	Fed. Rep. of Germany	358/335
2034995	10/1979	United Kingdom .	
2126002	3/1984	United Kingdom .	

OTHER PUBLICATIONS

Rundfunktechnische Mitteilungen, vol. 26, No. 6, Nov.–Dec. 1982, pp. 254–257, Norderstedt, DE, G. Hoffman et al., "Videotext Programmiert Videorecorder", *En entier*.

Merrell, "Tac-Timer," 1986 NCTA Technical Papers, pp. 203–206.

James, "ORACLE-Broadcasting the Written Word," Wireless World, Jul. 1973, pp. 314–316.

Carnes, "The Wired Household," IEEE Spectrum, Oct. 1979, pp. 61–66.

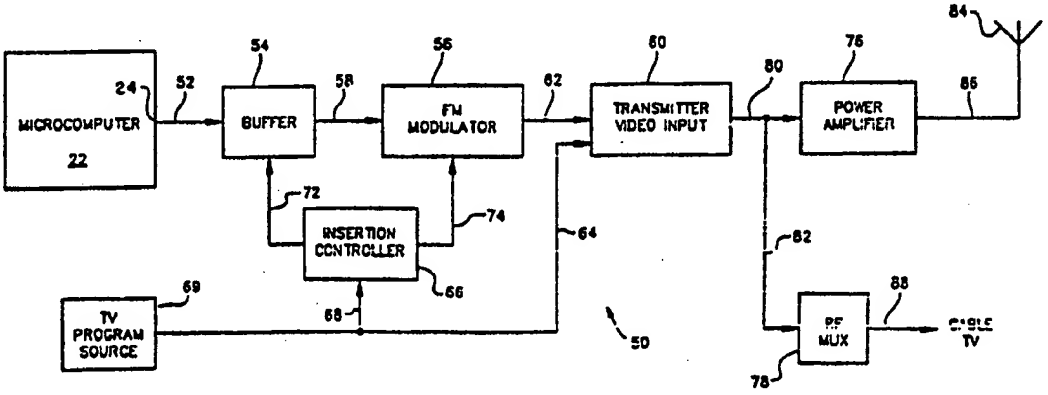
McKenzie, "ORACLE—An Information Broadcasting Service Using Data Transmission in the Vertical Interval," Journal of the SMPTE, Jan. 1974, pp. 6–10.

Edwardson et al, "CEEFAX—A Proposed New Broadcasting Service," Journal of the SMPTE, Jan. 1974, pp. 14–19.

Primary Examiner—James J. Groody

[57] **ABSTRACT**

A system (90) controls a television receiver (126) to allow user selection of broadcast programs from schedule information. A data processor (110) is connected to receive the schedule information from an FM receiver (94), decoder (98) and data demodulator (102). A user remote control transmitter 116-remote receiver (118) combination supplies user selection inputs to the data processor (110). The data processor (110) selects programs from the schedule information based on the user inputs. The schedule information for the selected programs is stored in a memory (111), and is used by the data processor (110) to control a programmable TV tuner (132) to provide the broadcast signals for the selected programs to the TV receiver (126) at the time of broadcast. The system (90) can also be used to control a VCR (150) for unattended recording of the selected programs.



REEXAMINATION CERTIFICATE ISSUED UNDER 35 U.S.C. 307

THE PATENT IS HEREBY AMENDED AS INDICATED BELOW.

Matter enclosed in heavy brackets [ ] appeared in the patent, but has been deleted and is no longer a part of the patent; matter printed in italics indicates additions made to the patent.

ONLY THOSE PARAGRAPHS OF THE SPECIFICATION AFFECTED BY AMENDMENT ARE PRINTED HEREIN.

Column 7, lines 33–59:

FIG. 3 is a block diagram of a receiver and television receiver control system 90 which is used in combination with the FM transmitter system 20 of FIG. 1. An FM antenna 92 receives the broadcast signals from the system 20, which are supplied to FM receiver 94 on line 96. FM receiver 94 supplies the FM broadcast signals to an SCA subcarrier decoder 98 on line 100. The decoder 98 strips the schedule information signals from the FM broadcast signals and supplies the schedule information signals to a data demodulator 102 on line 104. The data demodulator 102 converts the schedule information signals to digital form and supplies the digital schedule data signals to system control unit 106 on line 108, more particularly, to CPU 110 of the system control unit 106. A memory 111 is connected to the CPU 110 at 113. A control program for the system control unit 106 and a user identification code are stored in a read only memory (ROM) 112. ROM 112 communicates with the CPU 110 on line 114. Other inputs to the CPU 110 are supplied by a remote transmitter controller 116-remote receiver 118 combination on line 120, which supplies user selection and other user inputs to the CPU 110, and on line 122, connected to power input 124 of television receiver 126, which allows CPU 110 to determine if the receiver 126 is turned on. System clock 128 of the system control unit 106 is connected to the FM receiver 94 by line 130.

Column 15, lines 19–31:

PG+Schedule Setup

This mode allows the user to create a weekly reminder calendar *schedule stored in memory*, typically for weekly series and special events of non-weekly programs. The reminder process will set an alarm if the TV is not on before a certain time before the start of the program. If the TV is not on when the program starts, the reminder process will turn on the VCR to start recording the program.

The *reminder calendar* schedule may be programmed to respond to either a single program of a series or all programs of a series. For example, a daily or weekly show may be scheduled for a particular day or for all occurrences in the program listing.

Column 15, lines 46–58:

When the schedule mode is entered, a split screen displays the scheduled program on the top eight lines and the program list on the bottom eight lines. This listing is identical to the MG listing, except that a shortened listing is displayed instead of 16. All other MG parameters, such as Prime, Channel, and Theme are in effect. The user should review the MG status before setting up the *reminder calendar* schedule. Up to 16 programs can be entered in the *reminder calendar* schedule listing using two pages of display. The page keys 232 and 234 are used to access the second page. Either the up or down keys 232 and 234 will toggle the *reminder calendar* schedule listing.

A typical *reminder calendar* schedule is shown below:

Column 16, lines 5–14:

The cursor and pages keys 232–238 operation is identical to the MG mode except the range is restricted to either the upper or lower half of the display. If the cursor points to the top of the program listing (line 9), the listing will scroll down a half page (eight lines). If the cursor points to the bottom of the *reminder calendar* schedule (line 8), the *reminder calendar* schedule will shift to the next page. To cross from *reminder calendar* schedule to program list, and vice versa, the P key is used. The cursor will reposition itself to the top of the new selection.

Column 16, lines 18–27:

To add a program to the *reminder calendar* schedule, use the P key 240 to toggle the cursor to the program listing (lower half of display). Use the cursor, page, or + keys 232–234, 236–238 or 244 to locate the desired program. Use the SEL key 228 to store the program in the *reminder calendar* schedule. The upper screen will immediately display the new addition. If the page is full, the Program Master will automatically switch to the next page. If both pages are full, the status line will show a FULL message.

Column 17, lines 38–49:

A search of the program listing 352, *stored in program list buffer 303*, is made. The search is dependent on the status of the channel buffer, the theme buffer, the prime time buffer, and the direction of search. If the page 356 is up, the search direction is forward starting from the list pointer. If the page is down 357, the search direction will be backward 358 from the current list pointer. When the search satisfies the above criteria, the program listing *from program list buffer 303* is placed into the screen buffer 353. The search continues until the screen buffer is full 354 in which case the search is terminated. The status lines information is passed to the screen buffer and displayed 355 by the TV. *Program list buffer 303, screen buffer 353, and the other buffers discussed above comprise a data storage means.*

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

The patentability of claims 13, 16, 17, 32, 35, and 53 is confirmed.

Claim 8 is cancelled.

Claims 1, 4, 12, 14, 15, 18, 21, 29, 33, 34, 36–39, 42, 51, 52 and 54 are determined to be patentable as amended.

Claims 2, 3, 5–7, 9–11, 19, 20, 22–28, 30, 31, 40, 41, 43–50, 55, and 56, dependent on an amended claim, are determined to be patentable.

New claims 57–67 are added and determined to be patentable.

1. A system for controlling a television receiver to allow user selection of broadcast programs from schedule information *stored in a storage means*, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information *stored in said storage means* based on user inputs, *said* storage means *being* connected to receiver *a reminder calendar list comprising* the schedule information for programs selected by said data processor, and a programmable tuner for connection to the television receiver, said programmable tuner being connected to receiver control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply broadcast signals for the selected program to the television receiver, said data processor being configured to supply an actuating signal to a program recoder at the time of a broadcast program selected by said data processor and to supply the broadcast signal for the selected program to said program recorder, said system being configured to allow said television receiver to receive a different program than the broadcast signal for the selected program supplied to said program recorder, *wherein said user inputs comprise a plurality of user program selection criteria in addition to any time-period programs selection criteria, said data processor being configured to combine said plurality of program selection criteria and to present a list of programs meeting said combined program selection criteria, said user inputs further comprising a program choice from said presented list of program, said reminder calendar list comprising information identifying titles for said programs selected by said data processor.*

4. The system of claim 2 in which said data processor and said video display generator are further configured to present a preselected portion of the schedule information for the user selection, *wherein said preselected portion is preselected by said data processor according to at least one of a current time and a current channel of said programmable tuner.*

12. A system for controlling a television receiver to allow user selection of broadcast programs from schedule information *stored in a storage means*, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information *stored in said storage means* based on user inputs, *said* storage means *being* connected to receive *a reminder calendar list comprising* the schedule information for programs selected by said data processor, and a programmable tuner for connection to the television receiver, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply broadcast signals for the selected programs to the television receiver, said data processor being configured to provide signals to [said] *a* video display generator for presenting a plurality of user selection menus on the television receiver, and said second user selection input means includes a plurality of keys for making selections from the menus for choosing programs from the schedule information, said data processor being configured to [allow combinations of] *combine* the menu selections for choosing programs from the schedule information, *wherein said menu selections comprise a plurality of user program selection criteria, said data processor being configured to combing said plurality of user program selection criteria and to present a list of programs meeting said combined selection criteria, said menu selected further comprising a program choice from said presented list of programs, said remainder calendar list comprising information identifying titles for said programs selected by said data processor, said data processor being configured to present the reminder calendar list including program titles and to allow user selection therefrom.*

14. A system for controlling a television receiver to allow user selection of broadcast programs from schedule information *stored in a storage means*, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information *stored in said storage means* based on user inputs, *said* storage means *being* connected to receive *a reminder calendar list comprising* the schedule information for programs selected by said data processor, and a programmable tuner for connection to the television receiver, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply broadcast signals for the selected programs to the television receiver, said data processor being configured to supply an actuating signal to a program recorder at the time of a broadcast program selected by said data processor, said data processor being connected to a remote controller for said program recorder to supply control signals to said remote controller for recording of the selected program, *wherein said user inputs comprise a plurality of independent user program selection criteria, said data processor being configured to combine said plurality of user program selection criteria and to present a list of programs meeting said combined program selection criteria, said user inputs further comprising a program choice from said presented list of programs, said reminder calendar list comprising information identifying titles for said programs selected by said data processor.*

15. A system for controlling a television receiver to allow user selection of broadcast programs from schedule information *stored in a storage means*, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information *stored in said storage means* based on user inputs, *said* storage means *being* connected to receive *a reminder calendar list comprising* the schedule information for programs selected by said data processor, and a programmable tuner for connection to the television receiver, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply broadcast signals for the selected programs to the television receiver, said data processor being configured to supply an actuating signal to a program recorder at the time of a broadcast program selected by said data processor and to supply the broadcast signal

for the selected program to said program recorder, the broadcast signals including end of program information for at least programs of uncertain duration, and said data processor being configured to terminate recording by the program recorder in response to the end of program information, *wherein said user inputs comprise a plurality of user program selection criteria including channel and program theme criteria, said data processor being configured to combine said plurality of user program selection criteria and to present a list of programs meeting said combined program selection criteria, said user inputs further comprising a program choice from said presented list of programs.*

18. A process for controlling the presentation of broadcast programs to a television receiver, which comprises supplying program schedule information to *storage means in* a data processor, supplying user program selection criteria to the data processor, *said user program selection criteria comprising a plurality of independent user chosen program selection criteria and at least one program choice, the data processor* combining *said* user selection criteria, selecting those programs meeting the combined user selection criteria for viewing from the program schedule information in *said storage means in* the data processor, storing information identifying the selected programs, *said stored information identifying broadcast schedule times, channels, and program titles,* and using the stored information to tune the television receiver to the selected programs.

21. The process of claim 19 in which only a preselected portion of the schedule information is presented for the user selection, *wherein said preselected portion is preselected according to a combination of said independent user chosen program selection criteria.*

29. The process of claim 28 further including the steps of providing linking information to identify multiple programs of a single series and selecting the multiple programs of the single series on the basis of the linking information in response to user selection of one of the programs in the single series, *wherein said program schedule information provided to said storage means includes said linking information.*

33. A process for controlling the presentation of broadcast programs to a television receiver, which comprises supplying program schedule information to *storage means in* a data processor, supplying user program selection criteria to the data processor, *the data processor combining said user selection criteria with automatic criteria according to at least one of a current time period and a current channel,* using the *combination of* user selection criteria *and automatic criteria* to select programs for viewing from the program schedule information in *said storage means in* the data processor, storing information identifying the selected programs, using the stored information to tune the television receiver to the selected programs, turning on a broadcast program recording device for a selected broadcast program, recording the selected broadcast program, and supplying a different program broadcast signal to the television receiver than the broadcast signal for the selected program supplied to the program recording device.

34. A process for controlling the presentation of broadcast programs to a television receiver, which comprises supplying program schedule information to *storage means in* a data processor, supplying user program selection criteria to the data processor, *said user program selection criteria comprising a plurality of independent user chosen selection criteria and at least one program choice, the data processor combining said user selection criteria,* using the *combined* user selection criteria to select programs for viewing from the program schedule information in *said storage means in* the data processor, storing information identifying the selected programs *including broadcast schedule times, channels, and program titles,* using the stored information to tune the television receiver to the selected programs, turning on a broadcast program recording device for a selected broadcast program, recording the selected broadcast program, broadcasting end of program information for at least programs of uncertain duration, and terminating recording by the program recording device in response to the end of program information.

36. A process for controlling the presentation of broadcast programs to a television receiver, which comprises supplying program schedule information to *storage means in* a data processor, supplying user program selection criteria to the data processor, *said user program selection criteria comprising a plurality of independent user chosen selection criteria and at least one portion choice, the data processor combining said user selection criteria,* using the *combined* user selection criteria to select programs for viewing from the program schedule information in *said storage means in* the data processor, storing information identifying the selected programs *including broadcast schedule times, channels, and program titles,* using the stored information to tune the television receiver to the selected programs, turning on [the] *a* program recording device, and recording the selected program by supplying control signals to a remote controller for the program recording device.

37. A process for controlling the presentation of broadcast programs to a television receiver, which comprises supplying program schedule information to a data processor, *wherein said program schedule information includes linking information,* supplying user program selection criteria to the data processor, using the user selection criteria to select programs for viewing from the program schedule information in the data processor, storing information identifying the selected programs, using the stored information to tune the television receiver to the selected programs, providing *said* linking information to identify multiple programs of a single series and selecting the multiple programs of the single series on the basis of the linking information in response to user selection of one of the programs in the single series.

38. A process for controlling the presentation of broadcast programs to a television receiver, which comprises supplying program schedule information to *storage means in* a data processor, supplying user program selection criteria to the data processor, *said program selection criteria comprising a plurality of independent user chosen selection criteria and at least one program choice, the data processor combining said user selection criteria,* using the *combined* user selection criteria to select programs for viewing from the program schedule information in *said storage means in* the data processor, storing information identifying the selected programs *including broadcast schedule times, channels, and program titles,* using the stored information to tune the television receiver to the selected programs, determining whether the television receiver is operating prior to the time of a broadcast program selected by the process and providing an alarm signal to the user unless the television receiver is operating when the television receiver is checked for operation.

39. A system for controlling a television receiver to allow user selection of broadcast programs from schedule information *stored in a storage means*, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information based on user inputs, *said* storage means *being* connected to receive the schedule information for programs selected by said data processor, and a programmable tuner for connection to the television receiver, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply broadcast signals for the selected programs to the television receiver, a video display generator connected to receive signals from said data processor for generating a *combined* video display from the schedule information and the user selections on the television receiver, and a video switcher connected to receive video display signals from said video display generator, broadcast program signals from said programmable tuner and control signals from said data processor for selecting between the video display signals and the broadcast program signals for supplying to the television receiver, the schedule information also being broadcast, said first input means comprising a broadcast signal receiver connected to supply the broadcast schedule information to said data processor, said data processor being configured to provide signals to said video display generator for presenting a plurality of user selection menus on the television receiver, said second user selection input means including a plurality of keys for making selections from the menus for choosing programs from the schedule information, said data processor being configured to [allow combinations of the] *combine a plurality of* menu selections *as selection criteria, including a plurality of channel requirements*, for choosing programs from the schedule information.

42. A system for controlling a recording device to allow user selection of broadcast programs from schedule information, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information based on user inputs, storage means connected to receive the schedule information for programs selected by said data processor, a programmable tuner for connection to the recording device, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply broadcast signals for the selected programs to the recording device, and a television receiver, said system being configured to allow said television receiver to receive a different program than the broadcast signal for the selected program supplied to said recording device, *wherein said data processor is configured for a selectable display mode, said data processor being configured to present an initial display of said schedule information stored in said storage means upon selection of said display mode, said initial display automatically comprising schedule information for at least one of a current time period and a current channel of said programmable tuner.*

51. A system for controlling a recording device to allow user selection of broadcast programs from schedule information, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information based on user inputs, storage means connected to receive the schedule information for programs selected by said data processor, a programmable tuner for connection to the recording device, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply broadcast signals for the selected programs to the recording device, said data processor being connected to a remote controller for said recording device to supply control signals to said remote controller for powering on said recording device, starting and stopping recording of the selected program and powering off said recording device, *further comprising a display means coupled to said data processor, wherein said data processor is configured for a selectable display mode, said display means being configured to display an initial display of said schedule information stored in said storage means upon selection of said display mode, said initial display automatically comprising schedule information for at least one of a current time period and a current channel of said programmable tuner.*

52. A system for controlling a recording device to allow user selection of broadcast programs from schedule information, which comprises a data processor, a first input means for the schedule information connected to said data processor, a second user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information based on user inputs, storage means connected to receive the schedule information for programs selected by said data processor, a programmable tuner for connection to the recording device, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply broadcast signals for the selected programs to the recording device, the broadcast signals including end of program information for at least programs of uncertain duration, and said data processor being configured to terminate recording by the recording device in response to the end of program information, *further comprising a display means coupled to said data processor, wherein said data processor is configured for a selectable display mode, said display means being configured to display an initial display of said schedule information stored in said storage means upon selection of said display mode, said initial display automatically comprising schedule information for at least one of a current time period and a current channel of said programmable tuner.*

54. A system for controlling receipt of broadcast television programs to allow user selection of broadcast programs from broadcast schedule information *which is selectively stored in a storage means*, which comprises a data processor, a programmable tuner configured to receive both the broadcast programs and the broadcast schedule information connected to said data processor, means connected between said programmable tuner and said data processor for separating the broadcast schedule information from the broadcast programs and sup-

plying the broadcast schedule information to said data processor, a user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information *stored in said storage means* based on user inputs, *said* storage means *being* connected to receive *a reminder calendar list comprising* the schedule information for programs selected by said data processor, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply signals for the selected broadcast programs to at least one signal receiver for the selected broadcast programs, *wherein said user inputs comprise a plurality of user program selection criteria, said data processor being configured to combine said plurality of user program selection criteria and to present a list of programs meeting said combined program selection criteria, said user inputs further comprising a program choice from said presented list of programs, said reminder calendar list comprising information identifying titles for said programs selected by said data processor.*

57. A television schedule system for controlling receipt of broadcast television programs to allow user selection of broadcast programs from broadcast schedule information displayed on a television, said broadcast schedule information comprising broadcast schedule times, titles and channels, said system comprising:

a data processor;

a system clock connected to said data processor for providing a system time;

a programmable tuner connected to said data processor and configured to receive both the broadcast programs and the broadcast schedule information;

signal separating means connected between said programmable tuner and said data processor for separating the broadcast schedule information from the broadcast programs, and for supplying the broadcast schedule information to said data processor;

display means connected to said data processor for displaying at least a portion of said broadcast schedule information on said television;

user selection input means connected to said data processor for providing user inputs for selecting listings of programs from said displayed broadcast schedule information; and

storage means being connected to said data processor for storing schedule information, wherein said data processor is configured to select programs from said displayed broadcast schedule information based on said user inputs, to retrieve broadcast schedule information for said selected programs from said broadcast schedule information supplied to said data processor, and to store said retrieved schedule information in said storage means, said stored broadcast schedule information identifying a broadcast schedule time and channel and a program title for each said selected program; wherein

said data processor provides control signals to said programmable tuner when the system time matches a stored broadcast schedule time of one of said selected programs, said control signals causing said programmable tuner to supply broadcast program signals for the stored broadcast schedule channel of said one selected program to at least one signal receiver; and wherein

said data processor is configured for a selectable display mode, said display means being configured to display a preselected initial display of said schedule information stored in said storage means upon selection of said display mode, said preselected initial display automatically comprising schedule information meeting initial display selection criteria, said initial display selection criteria including at least one of a current time period and a channel currently selected by said programmable tuner.

58. The system of claim 57, wherein said data processor is configured to update said program listings of broadcast schedule information and said stored schedule information for selected programs, in response to updated schedule information being supplied to said data processor.

59. The television schedule system of claim 57, wherein said stored broadcast schedule information identifies a program description for each said selected program.

60. The television schedule system of claim 57, wherein said preselected initial display automatically comprises schedule information for a channel currently selected by said programmable tuner, and wherein said display means further comprises means for displaying on said television, upon a change to a new channel of said programmable tuner, broadcast schedule information for a current program on said new channel.

61. The television schedule system of claim 60, wherein said displayed current program broadcast schedule information comprises a title of said current program.

62. The television schedule system of claim 60, wherein said displayed current program broadcast schedule information comprises a remaining time of said current program.

63. The television schedule system of claim 57, wherein said user selection input means provides user selection criteria, the data processor being configured to combine a plurality of said user selection criteria with at least one selection criterion chosen automatically by said data processor according to at least one of a current time and a channel currently selected by said programmable tuner, said preselected initial display being of schedule information meeting said combined selection criteria.

64. A system for controlling receipt of broadcast television programs to allow user selection of broadcast programs from broadcast schedule information which is selectively stored in a storage means, which comprises a data processor, a programmable tuner congfigured to receive both the broadcast programs and the broadcast schedule information connected to said data processor, means connected between said programmable tuner and said data processor for separating the broadcast schedule information from the broadcast programs and supplying the braodcast schedule information to said data processor, a user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information stored in said storage means based on user inputs, said storage means being connected to receive a reminder calendar list comprising the schedule information for programs selected by said data processor, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply signals for the selected broadcast programs to at least one signal receiver for the selected broadcast programs, wherein said user inputs comprise a plurality of user program selection criteria including a plurality of channels, said data processor being configured to combine said plurality of user program selection criteria and to present a list of programs meeting said combined program selection criteria, said user inputs further comprising a program choice from said

presented list of programs, said remainder calendar list comprising information identifying titles for said programs selected by said data processor.

65. A system for controlling receipt of broadcast television programs to allow user selection of broadcast programs from broadcast schedule information which is selectively stored in a storage means, which comprises a data processor, a programmable tuner configured to receive both the broadcast programs and the broadcast schedule information connected to said data processor, means connected between said programmable tuner and said data processor for separating the broadcast schedule information from the broadcast programs and supplying the broadcast schedule information to said data processor, a user selection input means connected to said data processor, said data processor being configured to select programs from the schedule information stored in said storage means based on user inputs, said storage means being connected to receive a reminder calendar list comprising the schedule information for programs selected by said data processor, said programmable tuner being connected to receive control signals from said data processor at a time of a selected broadcast for causing said programmable tuner to supply signals for the selected broadcast programs to at least one signal receiver for the selected broadcast programs, wherein said user inputs comprise a plurality of user program selection criteria under a plurality of categories, said categories capable of being activated or deactivated, said user program selection criteria being stored for both activated and deactivated categories, said data processor being configured to combine said user program selection criteria for all currently activated categories and to present a list of programs meeting said combined program selection criteria, said user inputs further comprising a program choice from said displayed list of programs, said reminder calendar list comprising information identifying titles for said programs selected by said data processor.

66. A process for controlling the presentation of broadcast programs to a television receiver, which comprises supplying program schedule information to a storage means in a data processor, supplying user program selection criteria to the data processor, said user program selection criteria comprising a plurality of independent user chosen program selection criteria and at least one program choice, the data processor combining said user selection criteria, selecting those programs meeting the combined user selection criteria for viewing from the program schedule information in said storage means in the data processor, storing information identifying the selected programs, and using the stored information to tune the television receiver to the selected programs.

67. A process for controlling the presentation of broadcast programs to a television receiver, which comprises supplying program schedule information to a storage means in a data processor, supplying user program selection criteria to the data processor, the data processor combining said user selection criteria, selecting those programs meeting the combined user selection criteria for viewing from the program schedule information in said storage means in the data processor, storing information identifying the selected programs, and using the stored information to tune the television receiver to the selected programs, wherein a group of said selection criteria are combined by the data processor as logical alternatives so that the combination of said group of selection criteria is satisfied whenever any one of said selection criteria of said group is met.

* * * * *

APPENDIX D: Copy of Richards et al U.S. Patent No. 5,179,654

US005179654A

United States Patent [19]

Richards et al.

[11] Patent Number: 5,179,654

[45] Date of Patent: * Jan. 12, 1993

[54] **HELP PROVISION IN A DATA PROCESSING SYSTEM**

[75] Inventors: **Justin J. C. Richards**, Warwick; **Kenneth Williams**, Leamington Spa, both of England

[73] Assignee: **International Business Machines Corporation**, Armonk, N.Y.

[*] Notice: The portion of the term of this patent subsequent to Jun. 16, 2009 has been disclaimed.

[21] Appl. No.: **790,840**

[22] Filed: **Nov. 12, 1991**

Related U.S. Application Data

[63] Continuation of Ser. No. 469,549, Mar. 20, 1990, Pat. No. 5,122,972.

[51] **Int. Cl.**[5] **G06F 15/20**

[52] **U.S. Cl.** **395/157**; 395/161

[58] **Field of Search** 395/155–158, 395/160, 161, 144–149

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,555,775	11/1985	Pike	364/900
4,648,062	3/1987	Johnson et al.	364/900
4,752,889	6/1988	Rappaport et al.	364/513
4,789,962	12/1988	Berry et al.	364/900
4,821,211	4/1989	Torres	364/521
4,832,283	4/1989	Diehm et al.	364/518
4,899,276	2/1990	Stadler	364/300
4,970,678	11/1990	Sladowski et al.	364/900

FOREIGN PATENT DOCUMENTS

0056886	8/1982	European Pat. Off. .
0171663	2/1986	European Pat. Off. .
0249293	12/1987	European Pat. Off. .
0273248	7/1988	European Pat. Off. .

OTHER PUBLICATIONS

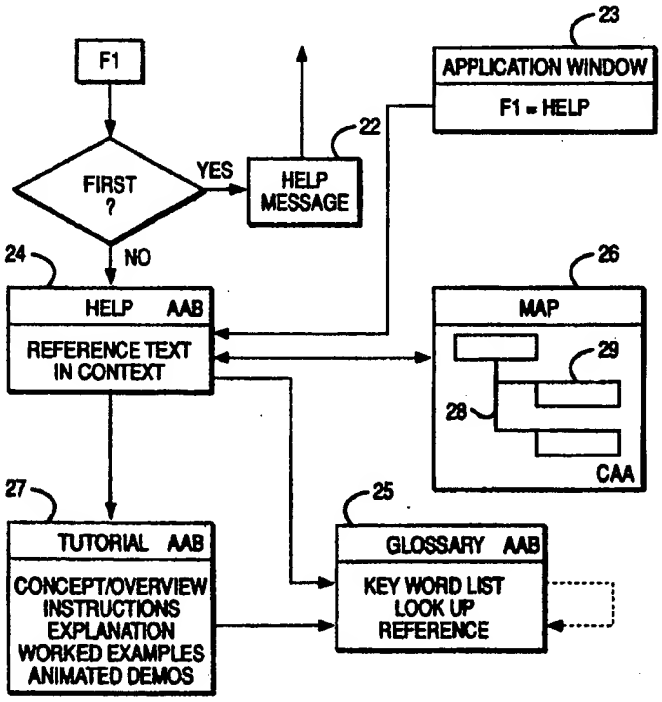
"Flat Hierarchical Menu," International Technology Disclosures, vol. 5, No. 1, Jan. 25, 1987.

Primary Examiner—Heather R. Herndon
Attorney, Agent, or Firm—Mark E. McBurney

[57] **ABSTRACT**

Help is provided to the user of a data processing system having a work station, including a display, and input means including a visible on-screen indicator and a selection means, in response to a request from the user, information on the current state of the system is used to address a store of hierarchical help text information, thereby providing contextual help text which is displayed in a separate window on the display screen alongside information related to the task in hand. A help map function is available which displays concurrently, separately from the help text, a portion of a hierarchical map of the stored help text to be replaced by new help text corresponding to the selected map entry.

21 Claims, 7 Drawing Sheets



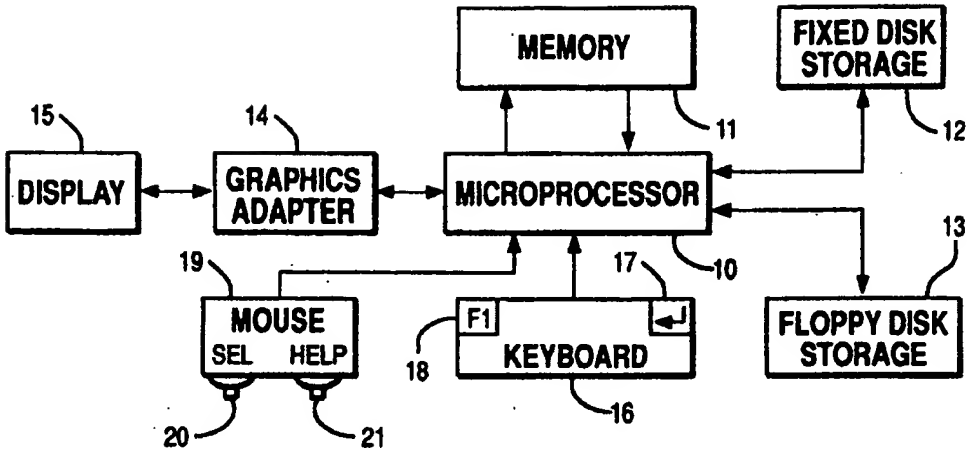

MEMORY
FIXED DISK STORAGE
15
14
11
12
DISPLAY
GRAPHICS ADAPTER
MICROPROCESSOR
13
19
17
10
MOUSE
SEL HELP
F1
KEYBOARD
FLOPPY DISK STORAGE
18
16
20
21

FIG. 1

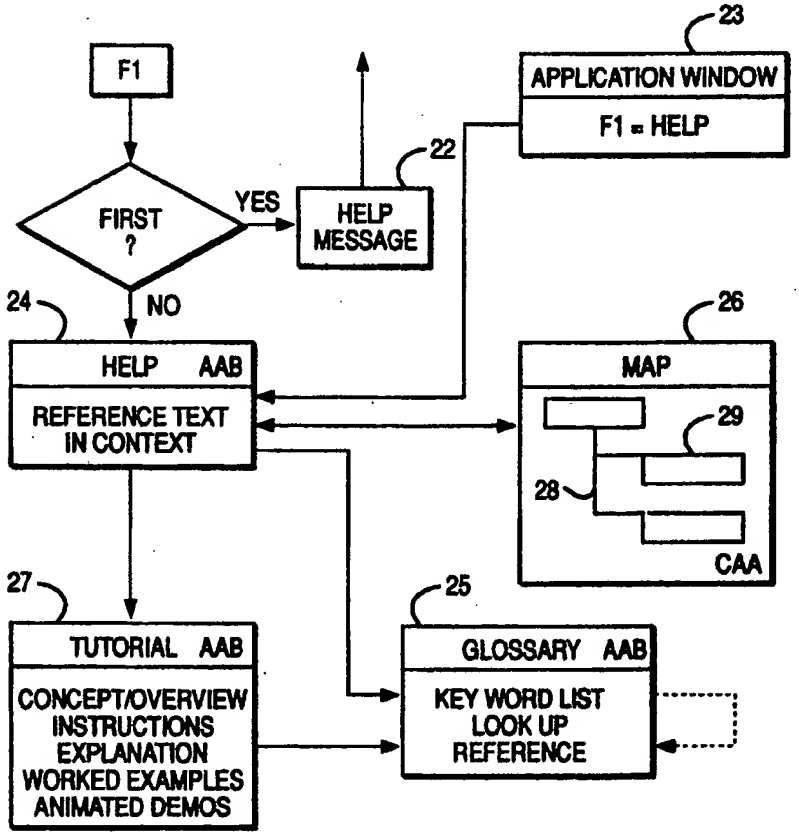

23
F1
APPLICATION WINDOW
F1 = HELP
22
FIRST ?
YES
HELP MESSAGE
NO
24
26
HELP AAB
REFERENCE TEXT IN CONTEXT
MAP
29
28
CAA
27
25
TUTORIAL AAB
CONCEPT/OVERVIEW
INSTRUCTIONS
EXPLANATION
WORKED EXAMPLES
ANIMATED DEMOS
GLOSSARY AAB
KEY WORD LIST
LOOK UP
REFERENCE

FIG. 2

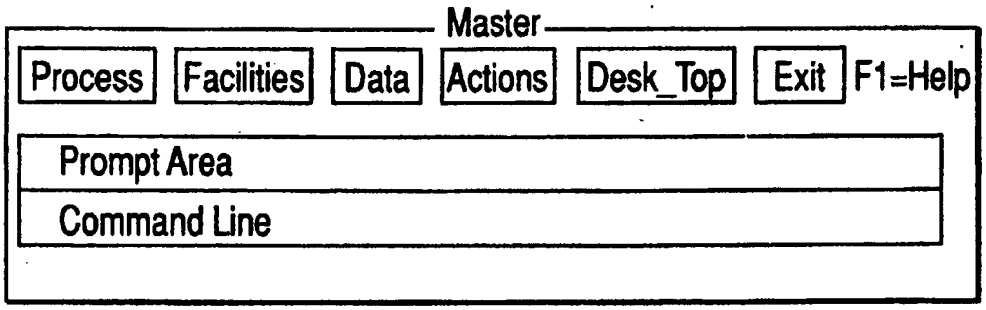

Master
Process
Facilities
Data
Actions
Desk_Top
Exit
F1=Help
Prompt Area
Command Line

FIG. 3

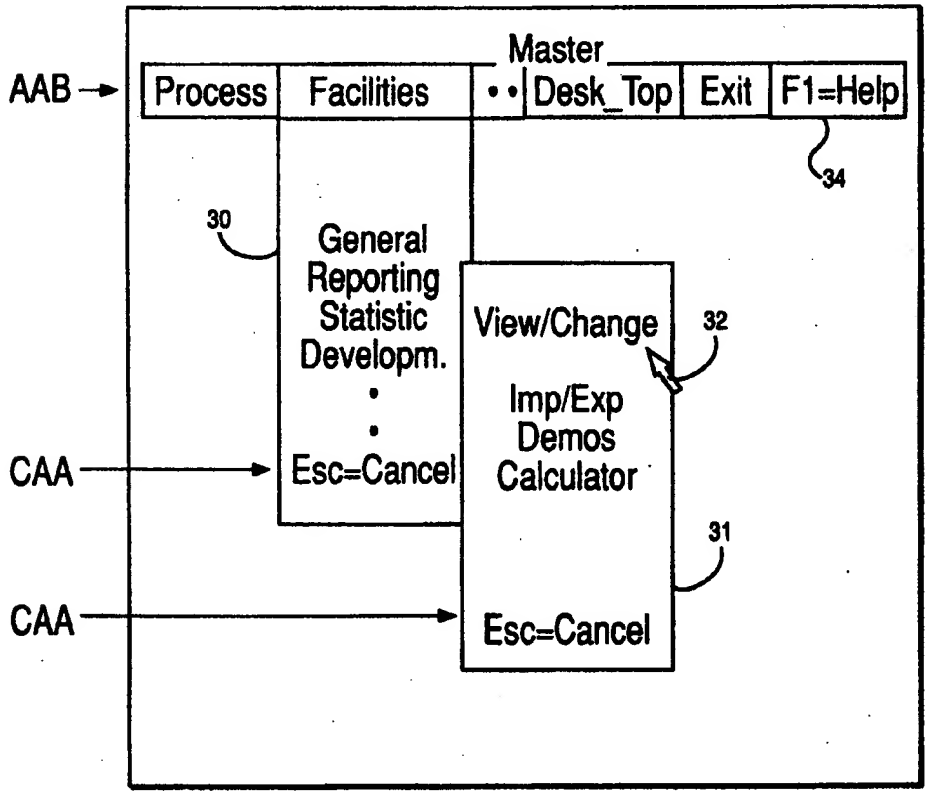

Master
AAB
Process
Facilities
Desk_Top
Exit
F1=Help
34
30
General
Reporting
Statistic
Developm.
Esc=Cancel
View/Change
32
Imp/Exp
Demos
Calculator
31
CAA
CAA
Esc=Cancel

FIG. 4

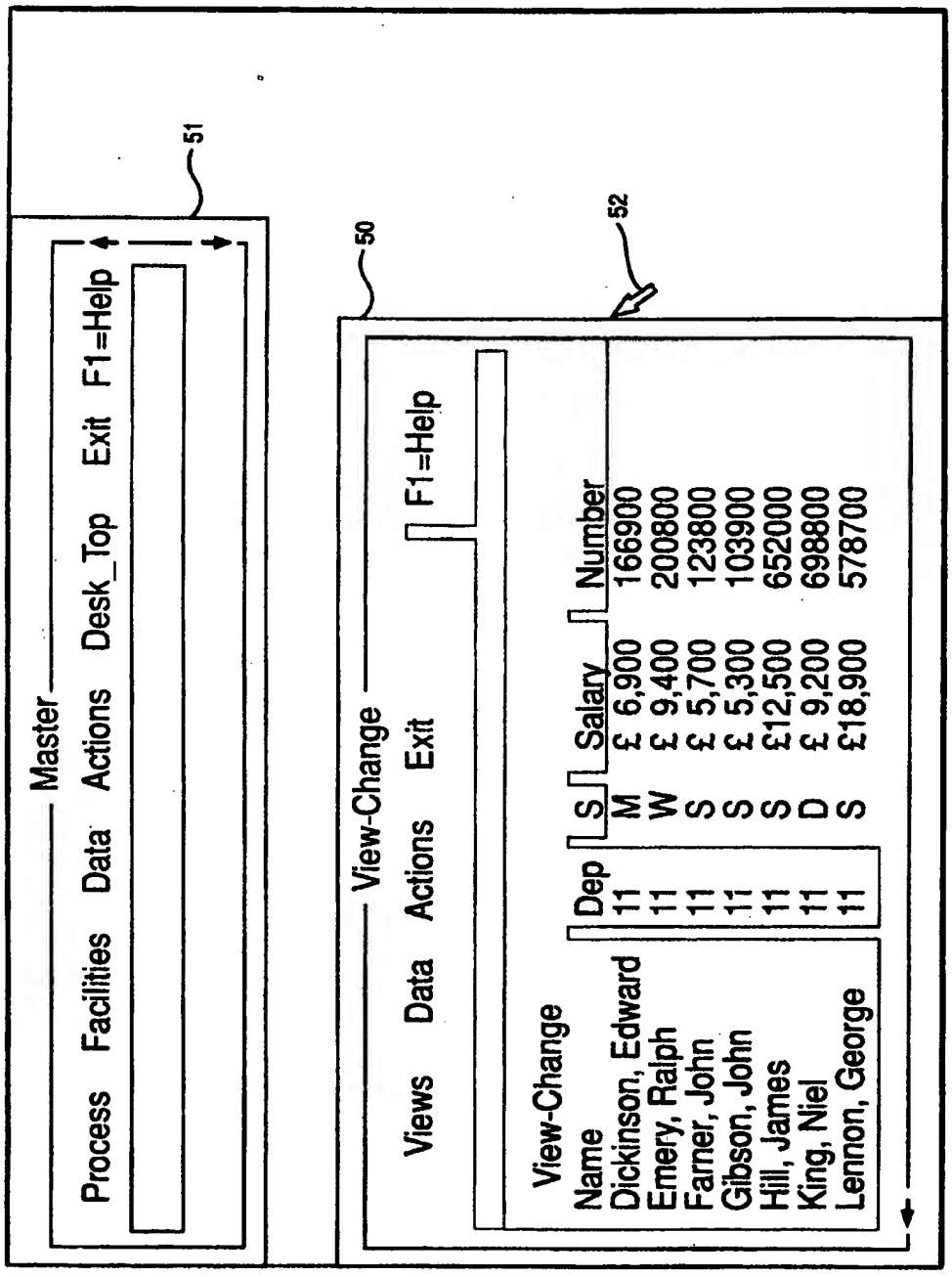

Master
Process Facilities Data Actions Desk_Top Exit F1=Help
51
50
52
View-Change
Views Data Actions Exit F1=Help
View-Change
Name Dep S Salary Number
Dickinson, Edward 11 M £ 6,900 166900
Emery, Ralph 11 W £ 9,400 200800
Farner, John 11 S £ 5,700 123800
Gibson, John 11 S £ 5,300 103900
Hill, James 11 S £12,500 652000
King, Niel 11 D £ 9,200 698800
Lennon, George 11 S £18,900 578700

FIG. 5

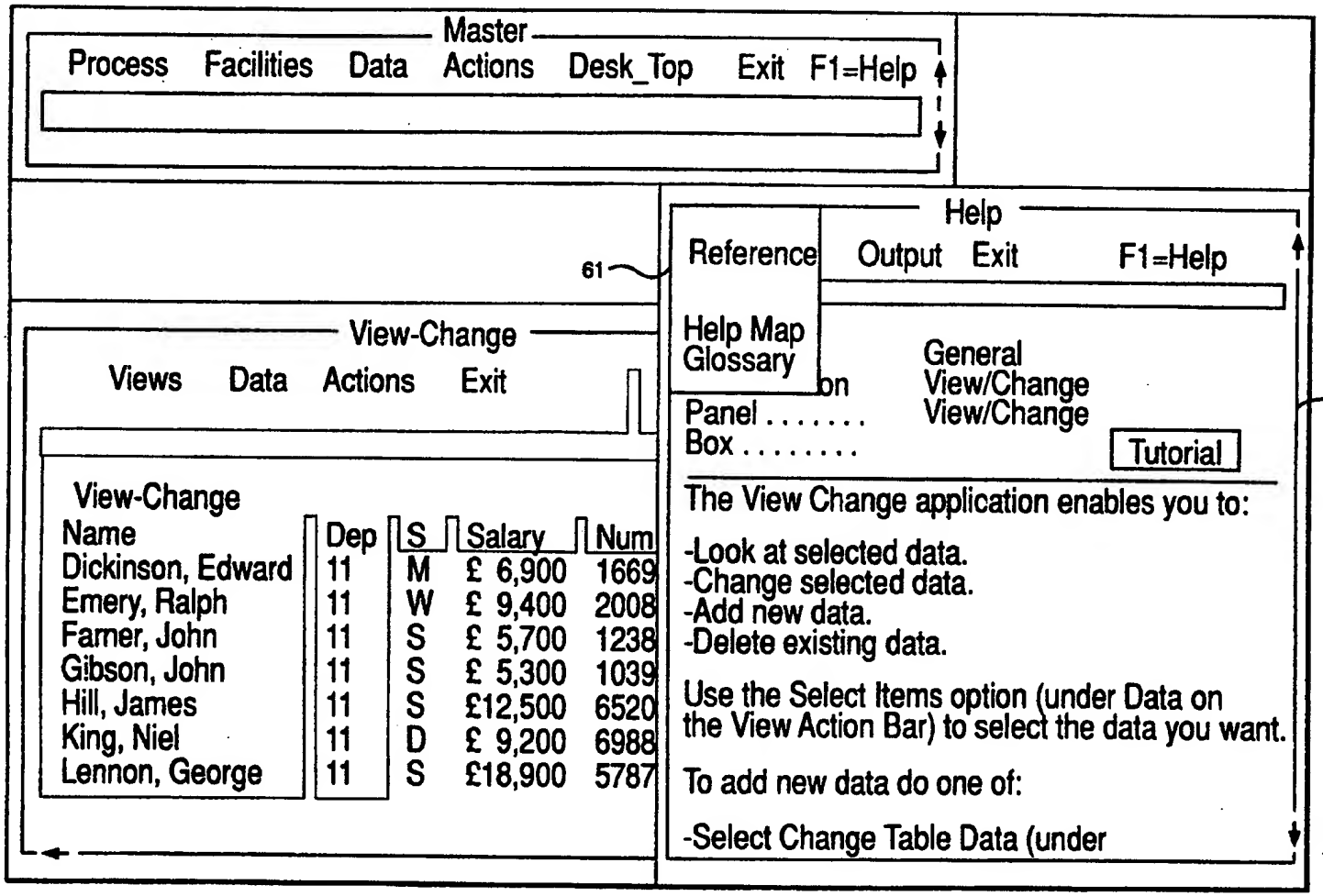

Master
Process Facilities Data Actions Desk_Top Exit F1=Help
61
Help
Reference Output Exit F1=Help
Help Map
Glossary
General
View/Change
View/Change
Panel .....
Box .....
Tutorial
60
View-Change
Views Data Actions Exit
View-Change
Name Dep S Salary Num
Dickinson, Edward 11 M £ 6,900 1669
Emery, Ralph 11 W £ 9,400 2008
Farner, John 11 S £ 5,700 1238
Gibson, John 11 S £ 5,300 1039
Hill, James 11 S £12,500 6520
King, Niel 11 D £ 9,200 6988
Lennon, George 11 S £18,900 5787
The View Change application enables you to:
-Look at selected data.
-Change selected data.
-Add new data.
-Delete existing data.
Use the Select Items option (under Data on the View Action Bar) to select the data you want.
To add new data do one of:
-Select Change Table Data (under

FIG. 6

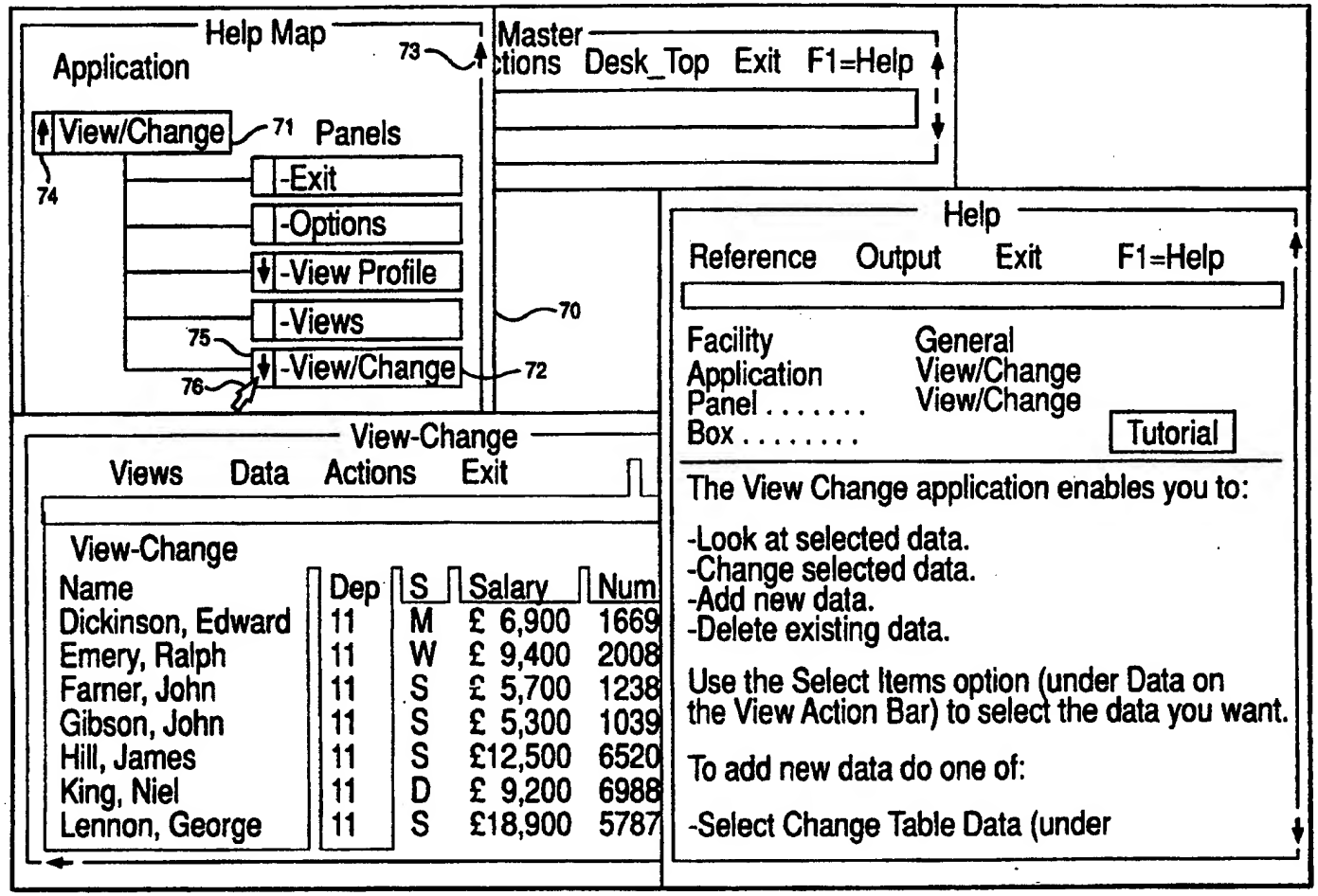

Help Map
Application
73
View/Change
71
Panels
74
-Exit
-Options
-View Profile
-Views
75
-View/Change
72
76
70
Master
tions Desk_Top Exit F1=Help
Help
Reference Output Exit F1=Help
Facility General
Application View/Change
Panel . . . . . View/Change
Box . . . . . Tutorial
The View Change application enables you to:
-Look at selected data.
-Change selected data.
-Add new data.
-Delete existing data.
Use the Select Items option (under Data on the View Action Bar) to select the data you want.
To add new data do one of:
-Select Change Table Data (under
View-Change
Views Data Actions Exit
View-Change
Name Dep S Salary Num
Dickinson, Edward 11 M £ 6,900 1669
Emery, Ralph 11 W £ 9,400 2008
Farner, John 11 S £ 5,700 1238
Gibson, John 11 S £ 5,300 1039
Hill, James 11 S £12,500 6520
King, Niel 11 D £ 9,200 6988
Lennon, George 11 S £18,900 5787

FIG. 7

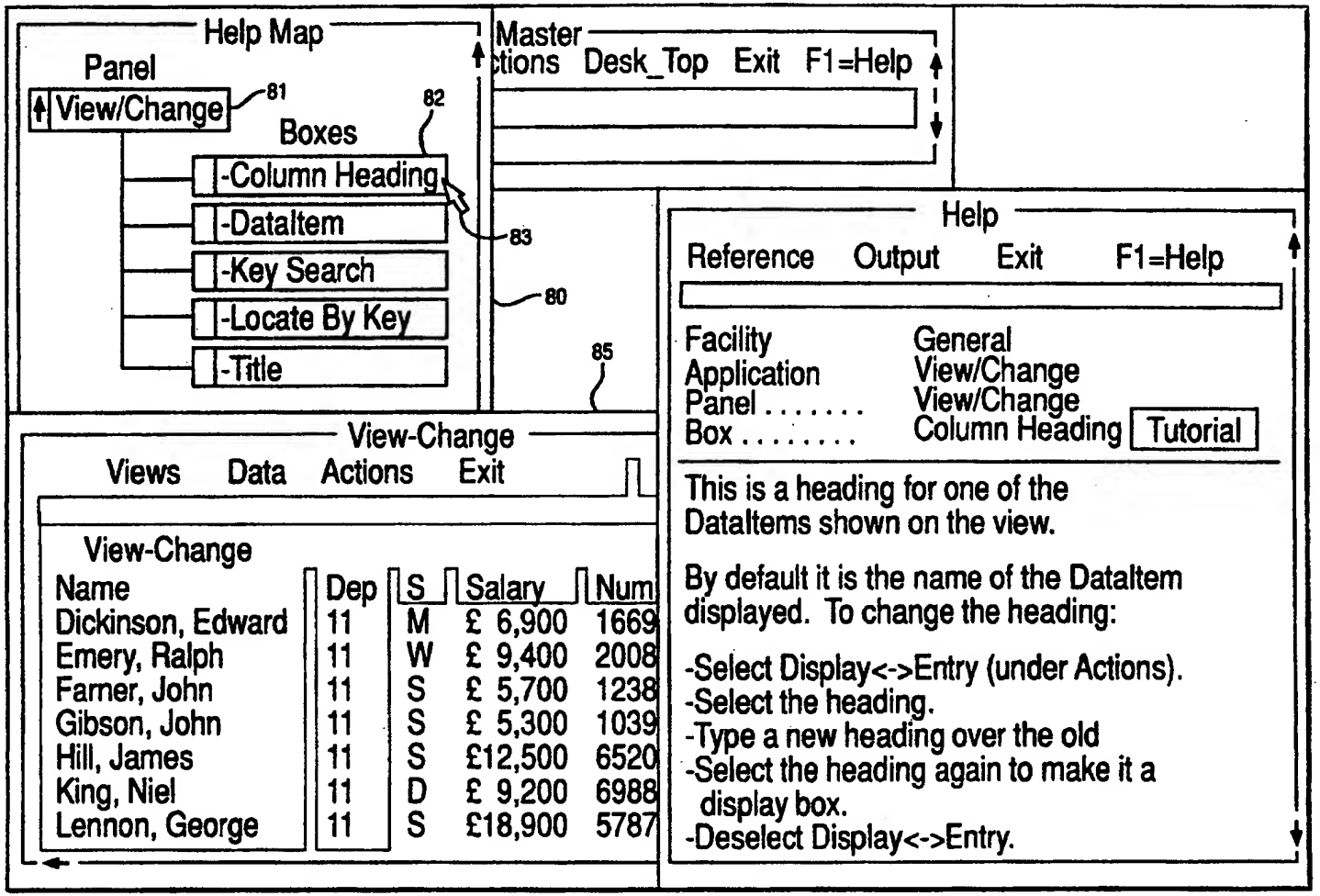

Help Map
Panel
View/Change
81
82
Boxes
-Column Heading
-DataItem
-Key Search
-Locate By Key
-Title
83
80
85
Master
tions Desk_Top Exit F1=Help
Help
Reference Output Exit F1=Help
Facility General
Application View/Change
Panel . . . . . View/Change
Box . . . . . Column Heading
Tutorial
This is a heading for one of the DataItems shown on the view.
By default it is the name of the DataItem displayed. To change the heading:
-Select Display<->Entry (under Actions).
-Select the heading.
-Type a new heading over the old
-Select the heading again to make it a display box.
-Deselect Display<->Entry.
View-Change
Views Data Actions Exit
View-Change
Name Dep S Salary Num
Dickinson, Edward 11 M £ 6,900 1669
Emery, Ralph 11 W £ 9,400 2008
Farner, John 11 S £ 5,700 1238
Gibson, John 11 S £ 5,300 1039
Hill, James 11 S £12,500 6520
King, Niel 11 D £ 9,200 6988
Lennon, George 11 S £18,900 5787

FIG. 8

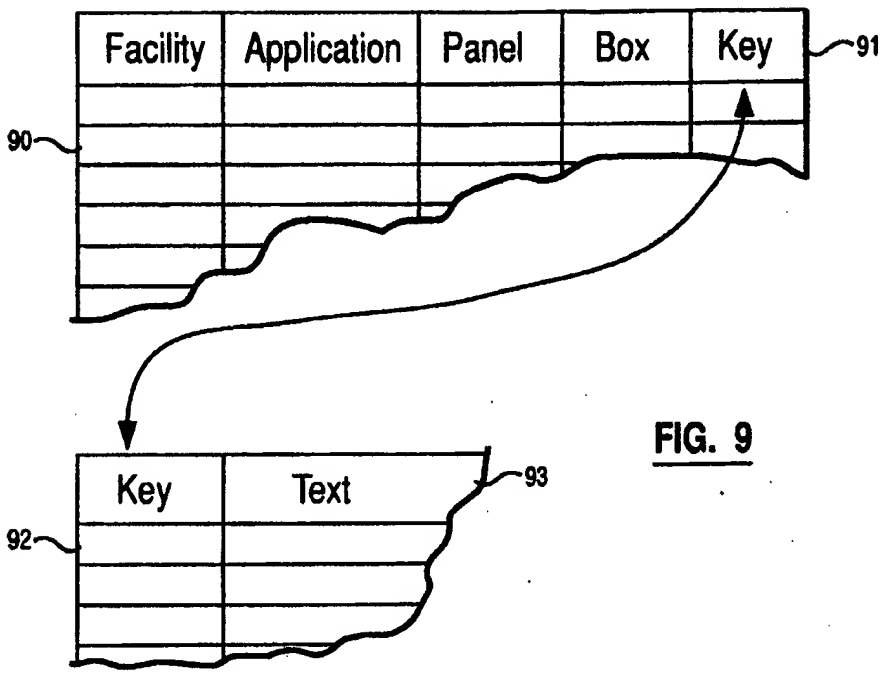

Facility
Application
Panel
Box
Key
91
90
Key
Text
93
92

FIG. 9

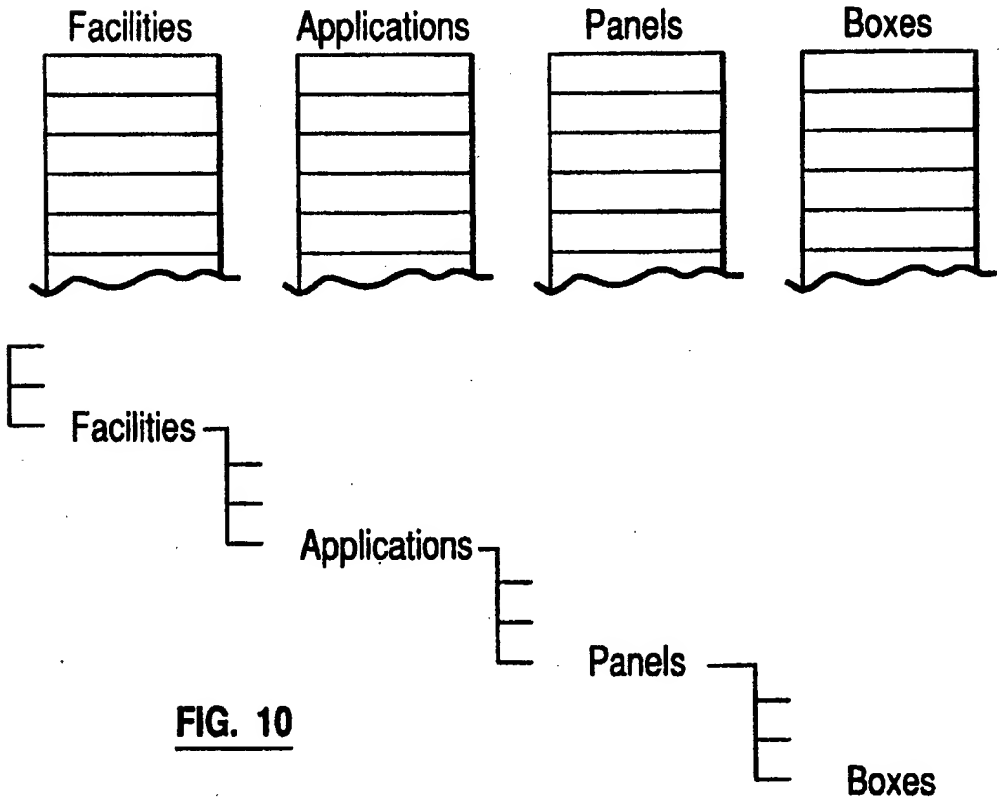

Facilities
Applications
Panels
Boxes
Facilities
Applications
Panels
Boxes

FIG. 10

HELP PROVISION IN A DATA PROCESSING SYSTEM

This application is a continuation of U.S. application No. 07/469,549 filed Mar. 20, 1990, now U.S. Pat. No. 5,122,972.

TECHNICAL FIELD OF THE INVENTION

The invention relates to data processing systems and to a method of providing help to a user of such a system.

BACKGROUND OF THE INVENTION

It is common practice for programmed data processing systems to provide help to an operator or user in response to a request for help. Such help is displayed to the operator at a workstation and frequently replaces the previous display screen entirely. Help may consist of actual help information or of a menu or index of possible help from which the operator is required to select an item. Such indices can be very extensive and laborious to search in themselves.

So called contextual help is known in which the help provided is not merely general to the current screen or application but is specific to the actual position of a cursor or pointer on the screen. Three related articles describing a contextual help system by R E Berry, S E Johnson et al. are found in the IBM Technical Disclosure Bulletin (Vol 27, No. 10B, March 1985 at pages 6126, 6127 and 6128). These articles show the provision of contextual help in windows on a display screen. Two types of Help panel are possible, Active and Passive. The Active panel allows the operator to make further unspecified selections from within the panel. However, no other provision for knowing what alternative help is available is made.

Another contextual help system making use of windowing capabilities is described in European patent application 0185845 A2, entitled "Help placement on a screen for a computer user". Help messages are displayed in a window which is so positioned in areas of the screen as to minimise the overlapping or obscuring of the screen content.

Also known in the provision of help to a computer user is the concept of multi-level help in which, if the initially displayed information (first level help) is inadequate, the user may request further more detailed information (second level help). Examples of systems employing multiple levels of help can be found in an article by D Koeller et al in the IBM Technical Disclosure Bulletin entitled "Improved method for Help Lookups" (Vol 29, No. 1 June 1986, P 291) and in European published patent application 0190419 A2 entitled "Method for providing an on-line help facility for interactive information handling systems".

DISCLOSURE OF THE INVENTION

The above mentioned prior art thus fails to provide easy location of alternative or related help at the same level as the contextual help initially provided.

Accordingly, the present invention provides a data processing system having a work station including a display for displaying on a screen panels of information relating to one or more tasks, the panels being viewable through windows under the control of a display manager, and operator input means by which an operator can communicate with the system interactively, the input means including indicator means for identifying items on the screen by means of a visible on-screen indicator, selection means for communicating a selection to the system on the basis of displayed information and help request means for requesting help information from the system; the system further including an addressable store of hierarchical help text information, contextual help means responsive to an appropriate request for help and to the current state of the system when help was requested to access the help text store to obtain appropriate help text and to cause the display manager to display said help text through a help text window on said screen, concurrently with the information related to the task or tasks in hand which was being displayed when help was requested, help map display means responsive to selection by said selection means to cause the display manager to display in a separate window, concurrently with said help text window, at least a portion of a hierarchical map of the stored help text, each entry of which corresponds to a unit of stored help text, and means responsive to selection of a map entry by said selection means to cause help text corresponding to the selected map entry to replace that in the help text window.

The invention also provides a method of providing help to a user of a data processing system having a work station including a display and operator input means by which an operator can communicate with the system interactively, the input means including indicator means for identifying items on the screen by means of a visible on-screen indicator, selection means for communicating a selection to the system on the basis of displayed information and help request means for requesting help information from the system; the system further including an addressable store of hierarchial help text information; the method comprising the steps of accessing the help text store in response to a request for help and to the current state of the system to obtain appropriate help text, displaying said help text concurrently with the information related to the task or tasks in hand, responding to selection of help map function by the user to display, separately from the help text but cocurrently therewith, at least a portion of a hierachical map of the stored help text each entry of which corresponds to a unit of stored help text and responding to a further selection by the user of an entry on the help map to display new help text replacing that originally displayed.

By providing a help map concurrently with the help text and application, the user is enabled, without losing track of the circumstances in which he first requested help, to consider and select alternative related help text at the same level which may be more appropriate to his needs. This does not exclude the known provision of help at different levels, in addition, such as, for example, a lower tutorial level of help.

Although selection could be made purely on the basis of a typed response to messages, it is preferable that the selection means is associated with the visible indicator so that the displayed item indicated by the indicator is selectable by operation of the selection means, This could involve selection of an item indicated by a cursor by operation of an entry key as a keyboard or could be effected with a light pen. However, the preferred implementation is a so called "mouse" device in which movement of a pointer on the display is caused by movement of the mouse. Depression of a selection button on the mouse selects the item indicated by the pointer.

In order for the contextual help means to access the help text store, it is preferred that the current state of the system be defined by a plurality of system state variables which the help means uses as addressing information. It is also preferred, that the system variables are ranked in an order corresponding to different orders of help text in the help text store. Thus, a system state defined by system variables including low order variables would result in a correspondingly low order (i.e more specific) help text whereas a system state defined only by high order variables would result in a correspondingly high order (i.e. more general) help text.

It should be noted, at this point, that the reference to help text of different order relates to the generality or specificity of the text and not to the provision of different help function at different levels of operation.

Although, in theory, the system variables could be used directly to address a help text store, it is preferred that the help text store is addressed by a key which is obtained from a key table to which the system variables are applied. The key can thus be an address actually used by the system memory whereas the system variables are essentially user or system function oriented. It will be realised that each system state, as defined by the system variables, does not necessarily correspond to a unique unit of help text. Some system states may share common help text so that addressing the key table will produce the same key.

Another preferred feature of the invention, related to the provision of contextual help, is that the low order system variables relate to the position of the indicator on the screen. Thus the corresponding low order help text can relate directly to the item or area identified by the indicator.

A convenient preferred version of this is that at least three orders of system variable are used corresponding to the application being executed, the current panel on the display screen which is owned by the application and any predefined box located within the panel. There are three corresponding orders of help text in the help store from high to low respectively.

It is also possible in some systems to have a fourth higher order of help corresponding to a system facility which owns the application.

Turning now to the help map itself, although it is possible for a static map to be stored by the system, there are advantages in generating the map dynamically from the help text store. One of these advantages is that users can add to or modify the stored help text which will immediately be reflected in the map next time it is created.

Clearly either a static or dynamic map may be too large to be viewed through the available window. It has been found preferable, where possible within the hierarchy, to select for display the map entries of the same order as the current system variables which share common higher order system variables and also to display the higher order entry represented by the common higher order variables.

If by any chance, the map entry corresponding the current system variables is not visible immediately within the help map window, the window can be scrolled or panned conventionally to reveal the remaining entries sharing the same higher order entry until the required entry is found.

Although scrolling and panning could be employed to reveal other areas of the map, it is preferable to provide a more systematic selectively operable branching mechanism for the user to move around the map. This operates so that branching may be selected on given map entries to cause display of a new help map. Where the given entry was originally one of the lower order entries, it becomes the higher order entry on the new map. Where the given entry was originally the higher order entry, it becomes one of the lower order entries on the new map.

To assist branching, the map entries preferably include icons, for example arrows, to indicate the permitted direction of branching. Where no further branching is possible from an entry, no icon is provided. The branching operation can be selected by any of the various selection techniques discussed above, the easiest being use of mouse and pointer.

Although the map offers a convenient method of navigation around the help text, it need not be the only method by which alternative text may be obtained. In a preferred version of the system, a unit of help text can include selectable branch words withing the body of the text which are associated with related units of help text. Branching to the related units of text occurs in response to selection of a selectable word by the indicator/selection means combination. The result of the branching operation is that the display manager replaces the original text in the help text window with the related text.

As a further variant on the above, a glossary store may also be provided so that, upon selection of a word of help text from which no branch is permitted, a definition of the selected word or alphabetically nearest word in the glossary store is displayed in a separate glossary window.

The invention will now be described in more detail, by way of example only, with reference to a preferred embodiment thereof as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of the major hardware components of a data processing system according to the invention;

FIG. 2 illustrates schematically the help available in the preferred embodiment of a data processing system according to the invention;

FIG. 3 illustrates the format of a Master window produced on the display in the preferred embodiment of a data processing system according to the invention;

FIG. 4 illustrates a display screen layout produced in the preferred embodiment at the point of selection of a View/Change application;

FIG. 5 shows a display screen resulting from the running of the View/Change application of FIG. 4;

FIGS. 6-8 shows successive display screens which are produced in the preferred embodiment as a result of employing certain of the help provision illustrated in FIG. 2;

FIG. 9 shows portions of a Help Index Table and Help Text Store employed in the preferred embodiment of the invention; and

FIG. 10 illustrates schematically the creation of Help Map in the preferred embodiment of the invention.

BEST MODE FOR CARRYING OUT THE INVENTION

A data processing system according to the invention comprises both hardware and software. The hardware of the system is illustrated in FIG. 1 and is conventional.

A microprocessor 10 communicates with a fixed memory 11 and with peripheral devices. These included fixed disk storage 12 and floppy disk storage 13 by way of which programs can be loaded to cause the system to execute data processing tasks. The results of there data processing tasks are displayed to an operator or user, by way of a graphics adapter 14, on a colour display 15.

Input to the system by the operator may be from keyboard 16 which has a normal range of keys, including an entry key 17 which may be used to indicate selection, and a help key 18 (labelled Fl) for requesting help from the system. As an alternative to requesting selection and help from the keyboard, a mouse device 19 is also provided. Movement of the mouse causes movement of a pointer on the screen of display 15. The mouse is provided with at least two distinct buttons, one of which, 20, indicates selection of the item at which the pointer is pointing and the other of which, 21, is a request for help, whose function is exactly equivalent to operation of the Fl key on the keyboard.

The software part of the data processing system consists of normal operating software for controlling operation of the hardware and an application program which the user desires to run.

One example of suitable hardware and operating system would be an IBM PS/2 computer (models 50, 60 or 80) with an IBM OS/2 (Release 1.0) operating system (IBM is a Registered Trademark and PS/2 and OS/2 are Trademarks of International Business Machines Corporation).

The application program which is part of the data processing system of FIGS. 1 and 2 is of the multi-tasking kind in which numerous tasks can run simultaneously. It consists of general system functions and a set of basic applications that enable general data manipulation and presentation to be performed.

The system functions include two primary components, the Display Manager and the Data Store Manager. The latter manages all data used by the system which is held in Data Stores. A Data Store is single level and contains various data values and attributes as Data Items. A data dictionary provides information about the individual Data Items which are referenced by symbolic names.

The Display Manager provides full display services in all points addressable mode. It is fully integrated with the Data Store.

The display manager allows many logical screens (panels) to be presented on the physical display 15. These panels are presented through windows which may be a different size from the related panel. The windows may be displayed with or without overlap. With the exception of data entry, any of these windows may be directly employed even if they are partly hidden by another window. Data entry may only be performed on the top most window, which is identified by the presence of a data entry cursor. The Display manager presents data from the DataStore; the application does not write data to windows. All applications present their information within these windows using panels. The panel is the application's defined display layout which will be presented somewhere on the physical display through a window.

The entire screen is available to display windows which are optimally placed by the display manager. All windows have borders and may overlay one another if necessary. The user may move a window, even partially off the screen. Error and warning messages plus help information appear through Pop-up windows

The physical screen is referred to as the 'desk top' and always contains a Master window giving access to all system function. The Master window occupies minimal screen space, containing a Prompt Area, Command Line and an Application Action Bar (AAB), consisting of a number of choices. Its format is as shown if FIG. 3

The Application Action Bar choices may be selected using keyboard 16 or mouse 19. On selection they present Pull-down windows with the following services:

Process: Initiation of saved specifications, programs and procedures;

Facilities: Initiation of any enrolled application;

Data: Data Dictionary Management function are provided via a data window;

Actions: Enable the user to perform various actions, set profile information and enroll new facilities and applications;

Desk Top: Manipulation of objects on the desk top;

Exit: Close down the system and any active applications:

By way of example, and as illustrated in FIG. 4 the facilities service is accessed via the Facilities AAB choice on the Master Window. Facilities include, among others, General, Reporting, Statistics and Development as shown in the pull-down window 30 in FIG. 4 which appears on the desk top when selected by means of the mouse 17 and pointer.

Access to individual applications within these facilities is achieved by selection of the relevant facility. This gives a Pop-up window containing a selectable list of applications. In the example of FIG. 4 the General Facility is selected and a pop-up window 31 lists the available applications. The pointer 32 is pointed at an application called View/Change which will be used to illustrate the help facilities of the system. Noteworthy in FIGS. 3 and 4 is any area 34, in the AAB designated "F1=Help". This is an alternative way of requesting help and requires the use of the pointer to point at area 34 and the operation of the select button on mouse 19.

Common Action Areas (CAA's) at the bottom of windows 30 and 31 enable the cancellation of the current panel. CAA's, in some cases, may also contain an "F1=Help" box.

As well as the Master window on the Desk Top, every application has a Main window with an Application Action Bar. An example in FIG. 5, shows a screen with the selected View-Change application in progress. In any application, Pull-down windows are presented below the AAB choice on selection. Secondary windows may be presented by the application for displaying information supplementary to that in the Main window. Pop-up windows may also be used to present very short term dialogues adjacent to a box on a Main or Secondary Window.

To assist with the description of the help function, a more precise definition of the terms "Window", "Panel" and "Box" is desirable.

Panels are virtual rectangular areas used to present information through the windows. Each panel consists of a rectangular area with a background colour, and optional foreground colour and pattern, and a set of boxes. Each panel is named.

Boxes are used to present character data or graphic objects within the panel. Each box is also rectangular and is named.

A window is a rectangular area through which panels are displayed the window is placed suitably by the Display manager unless the application specifies that the window be placed adjacent to a box in another window. During a session, users may reposition the windows if desired.

Each window is known by name to the application and the window size limit is essentially that of the panel it is displaying. A window has an initial size given by the associated panel but this may be changed by the application or 'Desk_Top' function. Windows are positioned suitably on the desk top by the system. However, the user may reposition a window. The cursor indicates the active window (for data entry purposes). Additionally, all windows have borders which clearly define the extent of the window. The top border contains a title. The border may also contain arrows that can be selected for scrolling.

Turning now to FIG. 2, a system for providing a total support environment for the user is illustrated. All the information necessary to use the system is available online, with a few exceptions. Help is available at three different levels and can be requested at any time during a session.

First level support is provided when the Help key 18 or 21 (Fl) is pressed once. A message 22 is displayed within a pop-up window and relates to the area under the pointer. The help provided is associated with either the box or panel at which the pointer is directed. This first level of support provides an instant clue for the user who is momentarily puzzled, or who requires very little information to get on the right track, but will probably be of little support to users who lack an understanding of the application they are using. First level help is provided by the application concerned.

Second level support is provided by the invocation of a special Help program when the user presses the Help key (F1) twice with the pointer in the same area, or by selecting an F1=Help box in an AAB in, for example, an application window 23. Second level help takes the form of a longer piece of text displayed within a Help window 24.

The information displayed is dependent upon which application the user is in, and at what point within that application. Support is contextual. Selecting the F1=Help box displays overview information about the application or facility which owns the box.

The Help window 24 provides the additional options of selecting access to a Glossary 25 for explanations of words or phrases, access to a hierarchical map 26 of the second level help text, and access to a third level of support, the tutorial 27.

Second level support is extremely flexible. The user who understands the concepts and purpose of an application, and who invokes support for clarification of a specific point, is likely to get exactly the information he needs. The user requiring more detailed or general information than that provided can use the map browsing facilities to move up or down a hierarchical level of information. The user who is out of his depth can access the tutorial level of support to discover the concepts behind application, and get an overview of its function and the tasks it supports. Selection of third level support is by selection of a "Tutorial" box in the help window 24.

Third level support is intended for first-time users of either the system or a particular application. A tutorial is explanatory in intent. It covers principles, facilities and typical tasks. It does not cover every possible task. It may involve a two-way information flow; the user may be asked to answer question or do exercises.

The four components provided by the main Help program are Text 24, Help Map 26, Glossary 25 and Tutorial 27. The first three can be concurrently displayed on the same screen whereas a Tutorial can only be concurrent with the Glossary.

The Help Text is provided in a main window 24 with AAB which is scrollable. It is invoked through initial support selection or via the Help Map 26. The Help Text function also allows branching by selection of a selectable word to alternative Text. If there is no alternative Text, the program branches to the nearest Glossary entry.

The Help Map is controlled by a sub-program invoked through Help Map selection on the Help Text window AAB. It provides a window based graphical tree structure 28 showing related Help Text titles and selection of the related Text items 29, which appear in the window 26. The Help Map program allows scrolled movement through the tree and branching up and down the tree structure.

The Glossary is also controlled by a sub-program invoked through Glossary selection on the Help Text window or the Tutorial.It provides definitions given by selecting a keyword from the Help Text or Tutorial or by typing in the desired word. If there is no entry for the desired word, the alphabetically nearest words in the Glossary are displayed.

Tutorials are also controlled by a sub-program invoked from the Help Text window. Tutorial text is provided in a main window 27 with AAB which is scrollable. As with Help Text, Tutorials allow branching by selection to alternative Text and branching by selection to a Glossary entry. They also replay recordings for demonstrations.

The structure and operation of the Help and Help Map programs will now be explained in more detail with particular reference to the screen examples shown in FIGS. 4–8. It will be assumed that as a result of the selection of the View/Change application from the window 31 of FIG. 4, the user has retrieved the table of data of employee salary details shown in FIG. 5, which is displayed in the application window 50, beneath master window 51. It is assumed the the user wishes to change the column headed "Salary" to read "Compensation" but does not know the procedure for doing so.

Although the experienced user would point the pointer 52 at the word "Salary" and, by pressing the F1 key twice, get the required contextual help on column headings, shown in FIG. 8, the less experienced user might well press F1 help with the pointer on the window border or in a blank area. Pressing F1 once, displays a Help message window containing the message "Select a View or Data Items to display the selected data". As this clearly does not provide the right sort of help, the user presses F1 again. This causes the View/-Change application to set the system variables defining the current state of the application and to call the Help program. The system variables define the Facility, Application, Panel and Box. In the example, the first three are set to "General", "View/Change" and "View/-Change" and null values are entered in the box. The name of the first panel in an application is always the same as that of the application, i.e "View/Change", though the system variable is a panel variable.

The Help program opens various panels of its own, including the main Help window corresponding to 24 (FIG. 2) and interrogates the system variables to determine the subject on which help is required. A title for the Help window is created. A Help Index table 90 is then interrogated, as illustrated in FIG. 9, to extract a key value 91 corresponding to the system variables. This key is used to interrogate a Help Text table 92 to extract corresponding Help Text 93 for display in the Help Window.

In the example, the text displayed is shown in Help window 60 in FIG. 6. This provides panel level help for the View/Change panel (which may be different from application level help). This still does not give the required information but is getting close to the subject of interest.

The user may then access the Help Map to find out what other help is available in this area. This is done by pointing the pointer at the word "Reference" in the AAB of window 60 which produces a small pull-down window 61 listing the two reference functions Help Map and Glossary. Pointing the Help Map entry and selecting it causes the display of a Help Map similar to that shown at 70 in FIG. 7.

Selection of Help Map causes a Help Map program to generate the help map by creating current lists of all Facilities, Application, Panels and Boxes. These are arranged in a tree structure as shown schematically in FIG. 10 in which higher order (or parent) entry has associated with it a number of lower order (or child) entries. The parent entry corresponding to the current system variables is determined and placed in the Help Map panel along with all child entries which share that parent. The lowest specified (i.e non-null) system variable is one of the child entries. Dynamic creation of the Help Map, as opposed to storing it statically, permits modifications and additions to the map to be made.

It may not always be possible to display all child entries in the Help Map window 70 and this is the case in the example chosen, the Help Map program initially displays the first five child entries in alphabetic order. Where the View/Change application entry 71 is the parent, the View/Change panel entry 72 is not one of the five initially displayed child entries. The Help Map window may however be scrolled downwardly as illustrated by arrows 73 in its border to bring the View/-Change panel entry 72 into view as shown in FIG. 7.

The various entries are enclosed in boxes which include sub-boxes at their left hand margins. The presence of an arrow in the sub-box indicates that there are further portions of the help map including the particular entry. An upward arrow such as 74 indicates that a higher level of map structure is available in which the View/Change application entry is a child entry. A downward arrow such as 75 indicates a lower level of map structure is available in which the child entry, such as View/Change panel is the parent entry.

Selection of an alternative portions of the Help Map is by pointing at the branching arrow and selecting. In the present, example the pointer 76 is used to select a downward branch from the View/Change panel entry.

The Help Map program then displays the lower level Help Map portion shown in window 80 of FIG. 8. At this point the displayed help text in window is unchanged from that in window 60 in FIGS. 6 and 7.

The new help map in window 80 contains the View/-Change panel entry 81 as parent, though this time with an upward branch arrow. The child entries relate to boxes within the View/Change panel and include an entry 82 entitled "Column Heading" Selection of entry 82 by pointer 83 causes the system variables to be reset to reflect those for the "Column Heading" box and the replacement of the Help Text in window 84 by new text relating to Column headings. The user now has enough information presented in the Help Text main window to enable him to make the change to the column heading "Salary" in the main application window 85.

It will be noted that the application window does not disappear when the Help Text and Help Map windows are opened, so that the user is unlikely to forget the problem which caused him to request help and can initiate the action directly.

It may also have been noted that there is an "F1=Help" area in the Help Text windows, 60 and 84, themselves. This is selectable by means of the pointer to produce help relating to the use of the Help function rather than on the subject of the text.

Help at levels above box level (i.e. panel level) may be selected by pointing and selecting blank areas and borders of the application window or the "F1=Help" area of its AAB. Help at the Application or Facility level must be selected from the appropriate display such as FIG. 3 or 4 or by branching up the map. The highest level of help is system level help obtained by branching upwards from Facility level help or by selecting contextual help on the overall application program name.

One further aspect of the help architecture of FIG. 2 is the use of branching from displayed Help Text words in the Help Text may be made selectable when it is created. Selection of such a work with the pointer causes the key to the current help text to be applied with the selected word to a Help Text Branch table. For each selectable word, the Help Text Branch table contains a Destination Key which is the key to Corresponding Help Text in the Help Text Table. The Help Text corresponding to the selected word replaces the original Help Text in the displayed window. Thus if the words "Column" or "Heading" had been predefined as selectable words in the View/Change help text of FIG. 7, selection of these words with the pointer would have produced the Column Heading help text without the need to use the Help Map.

As previously explained, if a word is not predefined as selectable, an attempt to select it results in a Glossary program being called which displays in yet another window, the selected word and its definition or the alphabetically nearest words.

Having described the principles of operation of preferred embodiment, illustrated by example, there follows a detailed description of the Help and Help Map programs.

65

Figure 3 or 4 or by branching up the map. The highest level of help is system level help obtained by branching upwards from Facility level help or by selecting contextual help on the overall application program name.

One further aspect of the help architecture of Figure 2 is the use of branching from displayed Help Text words in the Help Text may be made selectable when it is created. Selection of such a work with the pointer causes the key to the current help text to be applied with the selected word to a Help Text Branch table. For each selectable word, the Help Text Branch table contains a Destination Key which is the key to Corresponding Help Text in the Help Text Table. The Help Text corresponding to the selected word replaces the original Help Text in the displayed window. Thus if the words "Column" or "Heading" had been predefined as selectable words in the View/Change help text of Figure 7, selection of these words with the pointer would have produced the Column Heading help text without the need to use the Help Map.

As previously explained, if a word is not predefined as selectable, an attempt to select it results in a Glossary program being called which displays in yet another window, the selected word and its definition or the alphabetically nearest words.

Having described the principles of operation of preferred embodiment, illustrated by example, there follows a detailed description of the Help and Help Map programs.

Program Name: HELP

The Program consists of a number of "On Blocks" of code and Procedures as defined below.

Function: An application for providing in context help for a general application program. This is the master controlling task. This application is a basic system component. This task runs for the whole

of a PAS session, and provides for the display of second level help text, as well as controlling the other tasks. This task runs continuously so that a reasonable response time can be acheived for the display of help text. The application also has tasks which provide tutorials, glossary definitions and a help map. These are all started from this task when required. Separate tasks are also used for output of information to OS/2 files or printers.

Invocation: Help is started by the general application Control when the system is started up. Thereafter, any task may run to its QUEUE block, to request the display of second level help on a certain subject. This normally takes place when a task receives a HELP event signal, following the user pressing F1-F1 whilst the pointer is over one of the tasks windows. First level help is provided automatically by the system, for the first press of F1. The subject for which help is required is specified by settting the variables 'S.Help.Facility', 'S.Help.Application', 'S.Help.Panel' and 'S.Help.Box' prior to running to the QUEUE block of this task. These variables will have default values loaded into them by the system following an F1-F1, and often do not need to be explicitly set by the calling task.

Panels opened: HelpMain
HelpAABRef
HelpAABAct

HelpAABExt

ON Blocks: BREAK

DESKTOP
ERROR
HELP
QUEUE
QUIT
SCROLL
SELECT
START
STOP

Procedures:	DETSUBJECT	Determine help subject.
	EXITSELECT	'Exit' pull-down handler.
	FINDKEYS	Find keys for text and tut'l.
	GETTEXT	Get text for specified key.
	GETWORD	Extract word from string.
	MAKETITLE	Set up title boxes.
	BRANCH	Branch to new piece of text.
	REFSELECT	'Reference' popdown handler.
	ACTSSELECT	'Output' popdown handler.
	QUEUESUPPORT	Queue 'Support' if possible.
	SETPOINTERS	Set up pointers to help data.
	TEXTSELECT	Handler for selects on text.
	TUTSELECT	'Tutorial' button selects.

Tasks started:
I.HelpMap
I.HelpGlos
I.HelpPr
I.HelpTut
General.ShowErr

Input:	I.Messages.Help	- Translatable strings used by the whole Help application, for prompts etc.
	General.Messages. General	- Translatable strings for general use by all

programs.

User input	-	From selections etc.
S.Help.Facility, S.Help.Application, S.Help.Panel, S.Help.Box	-	Define the subject for which help text is to be displayed. Set prior to running this tasks' QUEUE block.
.HelpIndex.	-	Help index tables, which occur in DataStores which contain help text or tutorials. Used to relate the help subject, as specified in the 'S.Help.' variables, to a title, piece of help text and tutorial.
.HelpText.	-	Help text tables. Used to store the pieces of help text.
.HelpTxBra.	-	Help text branch tables. Used to hold the data for branches between various pieces of help text.

Output: A screen display of help text, which may optionally be output to an OS/2 file or printer.

Process: The Help application consists of 7 modules which have the following functions:-

Help - This is the main application module. It runs continuously, and provides the main help text display function. It also controls the

starting of the tutorial, help map and glossary

modules. It uses a separate module to handle the printing of help text. It provides the variables through which all the modules communicate to one another.

HelpMap - This module is used as a sub-task by the Help module. It produces a help map, which shows the user all the help text available within the system. The help map is used in conjunction with the main help text display.

HelpTut - This module is started as a master task by the Help module. It prodvides a tutorial for the user, on the specified subject. Once started the tutorial can be used independantly of the rest of the help system.

HelpGlos - This module is started as a master task by the Help module. It displays glossary definitions for words, to the user. Once started the glossary can be used independantly of the rest of the help system.

HelpPr - This module is started by the Help module, as a master task. It is used to control the printing of help te

HelpTuPr - This module is started by the HelpTut module, as a master task. It is used to control the printing of tutorial text.

HelpGlPr - This module is started by the HelpGlos module, as a master task. It is used to control the printing of glossary definitions.

Errors: No error should occur during normal running of this program. Any that do are unexpected, and are passed to the 'ShowErr' program as normal.

The procedures are described below.

Procedure name: DETSUBJECT

Function: This procedure determines the subject for which Help is required by examining the appropriate variables for data passed from the queueing task. The variables 'FacName', 'AppName', 'PanName', and 'BoxName' are set to indicate the required Help subject.

Parameters: No

Called by: ON QUEUE

Calls: None

The actions performed by this procedure are as follows:-

Determine help subject.

Determine the facility, application, panel and box for which Help has been requested. All tasks which queue/run to the Help applications' ON QUEUE block pass this information in the appropriate 'S.Help.' variables. Ensure that the subject defining variables never contain unknown values.

Procedure name: EXITSELECT

Function: This procedure is called whenever a selection is made on the 'Exit' popdown.

Parameters: No

Called by: ON SELECT

Calls: None

The actions performed by this procedure are as follows:-

Exit' pull-down handler. When 'Exit Help' is selected queue to the stop block, which quiesces the application.
When 'Resume Help' is selected just remove the popdown.

Procedure name: FINDKEYS

Function: This procedure checks the current datastore to see if it has a Help index table. If it does it searches this for a reference to some Help on the specified subject. If an appropriate entry is found in the Help index table the procedure returns the key to the Help Text in 'TextKey' and the Tutorial key in 'TutKey'. If either of the keys is not found it is set to 0.

Parameters: Yes

Called by: ON

QUEUE

Calls: None

The actions performed by this procedure are as follows:-

Find keys for text and tut'l. Clear the keys. If the datastore contains a help index table with a column for help text keys. Search for an entry for the required subject in the Help index table. If no entry was found for the required subject then no Help Text key is available. If

an entry was found in the index then determine the key to the Help Text. If the key does not contain a valid value then clear it. If the datastore contains a help index table with a column for tutorial keys. Search the Help index table for an entry for the specified subject. If the subject was a box then ignore the box name and find the entry relating to the panel that the box is on. This is because boxes do not have their own tutorials, but use those for the panel that they exist on. If no entry was found for the required subject then no tutorial key is available. Get the Tutorial key. If the key does not contain a valid value then clear it.

Procedure name:	GETTEXT
Function:	This procedure checks that the current datastore contains a help text table, and if it does then it attempts to retrieve the help text specified by the key. If it is successful then this text is put into the vector 'Text' otherwise the vector is cleared.
Parameters:	Yes
Called by:	BRANCH ON QUEUE Calls: None

The actions performed by this procedure are as follows:-

Get text for specified key.

Clear the vector for returning the text in.

If the datastore does not have a help text table then no help text is available.

If the specified key is invalid then no text can be found.

Search for the first line of Help Text.

If it is not found then no Help Text is available.

Retrieve the Help Text by loading lines from the Help Text table into the 'Text' vector until a line is encountered which has a different key to the required Help Text.

Procedure name:	GETWORD
Function:	This procedure attempts to determine the word in the specified string that occurs at the specified character position within that string. If a word is found it is returned in 'Word', otherwise a null string is returned. The procedure separates words using separators defined in the string 'I.Messages.Help_13_'.
Parameters:	Yes
Called by:	TEXTSELECT
Calls:	None

The actions performed by this procedure are as follows:-

Extract word from string.

Check that the values passed in the parameters are valid.

Define the separators.

If the character at the specified position is a separator then no valid word can be found.

Search for the start and end of the word, which contains the character at the specified position.

Split the word out of the string.

Procedure name:	MAKETITLE
Function:	This procedure sets up the title for the Help Text based on the subject for which help was requested.
Parameters:	Yes
Called by:	BRANCH

ON QUEUE

Calls: None

The actions performed by this procedure are as follows:-

Set up title boxes.

If there is no index table column containing titles, set the title to show the real facility, application, panel and box names.

Determine the facility title from the Help index table entry for the facility. If non is found use the internal system facility name. If no facility was specified then use the internal name, which is null.

Determine the application title in the same way as for the facility title.

Determine the panel title in the same way as for the facility title.

Determine the box title in the same way as for the facility title.

Procedure name: BRANCH

Function: This procedure is called when it is required to branch to another piece of Help Text in the current datastore, specified by 'DKey'. The procedure checks that the piece of text exists and has an entry in the Help index table (to provide title etc), before it attempts to execute the branching operation. If the branch is successful then the flag 'BranchOK' is set, otherwise it is cleared.

Parameters: Yes

Called by: TEXTSELECT

Calls: GETTEXT
MAKETITLE

The actions performed by this procedures are as follows:-

Branch to new piece of text.

Attempt to retrieve the new Help Text.

Then try to find an entry for it in the Help index table (which provides its title, associated facility names etc).

If both these tests pass then execute the branch:

Set the new values into the subject defining variables from the index table entry for the new Help Text.

Update the Help Text key.

Attempt to retrieve the key to any related Tutorial from the appropriate Help index table entry.

Hide or show the 'Tutorial' box, depending on whether one is available for the new subject or not.

Create the new title for the new text.

Copy the new text to the screen display.

Flag the branch as successful.

Otherwise, if either of the checks failed then flag the branch as unsuccessful.

Procedure name:	REFSELECT
Function:	This procedure is called whenever a selection is made on the 'Reference' popdown.
Parameters:	No
Called by:	ON SELECT
Calls:	None

The actions performed by this procedure are as follows:-

Reference' popdown handler.

When 'Help Map' is selected;

Set up the variables which are used to pass the Help Map subject to the Help Map subtask,..

..and either start the subtask or, if it is already active, just queue to it.

When 'Glossary' is selected;

If the 'Glossary' task is not already started,..

..set up the variables which are used to pass the Glossary subject to the Glossary task,..

!..and start it.

Hide the popdown.

Procedure name:	ACTSSELECT
Function:	This procedure is called whenever a selection is made on the 'Output' popdown.
Parameters:	No
Called by:	ON SELECT
Calls:	None

The actions performed by this procedure are as follows:-

'Output' popdown handler.

Hide the popdown.

Depending on which printing or filing option was selected set the mode for the print task accordingly.

Set the subject defining variables to be passed to the print task.

Start the Help Text print task.

Procedure name: QUEUESUPPORT

Function: This procedure is called from the 'ON QUEUE' block, at the beginning of the processing of a help request. It checks to see if any of the support tasks are active, and if there are it queues to the appropriate one (providing that it is not a request from the task itself). This enables 'F1' keystroke requests to be routed to the support product when it is active, rather than producing help requests. If a support task is queued to then the flag 'SupportQd'is set, otherwise it is cleared.

Parameters: No

Called by: ON QUEUE

Calls: None

The actions performed by this procedure are as follows:-

Queue 'Support' if possible.

Clear the success flag.

If the help request is from 'Support' itself, then don't queue back to it.

Determine the task handle of the most appropriate active support task (if any).

If there is one queue to it. The subject is communicated to the support task via the 'S.Help.' variables, which are already set prior to queueing/ running this application.

Procedure name: SETPOINTERS

Function: This procedure is called from the 'ON QUEUE' block. It determines the name of the datastore in which Help for the required subject will be found,

and sets up pointers to the columns in the help index and help text tables in the datastore. If any columns of the tables are unusable then the pointers to them are set to null strings.

Parameters: No

Called by: TEXTSELECT

Calls: None

The actions performed by this procedure are as follows:-

Set up pointers to help data.

Set all the pointers to nulls.

If a datastore is found with the same name as the specified facility then use it, else quit here.

If any of the help index table key columns is missing quit here.

Set up pointers to the help index table key columns.

Set up a pointer to the help index table help text keys column, if one exists.

Set up a pointer to the help index table tutorial keys column, if one exists.

Set up a pointer to the help index table titles column, if one exists.

If any of the help text table columns is missing quit here.

Set up pointers to the help text table text key and lines of text columns.

If any of the help text branch table columns is missing quit here.

Set up a pointer to the help text branch table destination key column.

Procedure name: TEXTSELECT

Function: This procedure is called whenever a selection is made in the area that displays the Help Text in the main window (i.e. a when a word of the Help Text is selected).

Parameters: No

Called by: ON SELECT

Calls: GETWORD
SETPOINTERS
BRANCH

The actions performed by this procedure are as follows:-

Handler for selects on text.

Determine which word, if any, was selected.

If no valid word was selected do nothing.

If a valid word has been selected from the Help Text then check if it has been set up to cause a branch, and if it has and the branch is possible then branch to the new piece of Help Text.

Reset the pointers to the help tables in the datastore, in case either the tables or datastore have been altered.

Check that a valid Help Text branch table exists in the datastore.

Check that a branch has been set for the selected word in this piece of text.

If it has then attempt to branch to the new Help Text.

If the branch was sucessful then don't go on to provide a Glossary definition.

If a valid word was selected from the Help Text but no branch took place, then attempt to find a glossary definition for the selected word.

Set up the inter task communication variables,..

..and either start the task or, if it is already active, just queue to it.

Procedure name:	TUTSELECT
Function:	This procedure is called whenever the 'Tutorial' button in the main window is selected. It sets up the variables which are used to pass the subject for the Tutorial and either starts or queues to the 'HelpTut' task.
Parameters:	No
Called by:	ON SELECT
Calls:	None

The actions performed by this procedure are as follows:-

'Tutorial' button selects.

Set up the variables which are used to pass the Tutorial subject to the Tutorial task,..

..and either start the task or, if it is already active, just queue to it.

ON Name:	BREAK
Function:	This block is executed whenever a BREAK occurs whilst this task is running. This can only occur during the ON START block, and causes the system to be shut down, as Help is started during the initial system startup. BREAKs are not allowed anywhere else as there are no slow processes performed.

Calls: None

The actions performed by this block are as follows:-

Create an outstanding BREAK event, which will be detected by Control.

Then just stop.

ON Name: DESKTOP

Function: This block is executed whenever a desktop operation is performed in a window which is owned by this task.

Calls: None

The actions performed by this block are as follows:-

Clear the prompt area.

Remove any outstanding 'ShowNote' messages.

If the desktop operation is a print or zoom then it can be ignored.

Ignore any panels which are not provided by this program, specifically panels used for the AAB, CAA and prompt areas.

If the panel that the operation acts upon is not already recorded as being changed then add it's name to the vector of changed panel names.

ON Name: ERROR

Function: This block is called whenever an execution error occurs whilst this program is running.
The 'ShowErr' program is started to provide some diagnostic information for debugging purposes, as is standard practice. No errors should occur during normal operation of this program, thus no attempt is made to trap or handle any.

Calls: None

The actions performed by this block are as follows:-

For debugging purposes.

ON Name:	HELP
Function:	This block is executed whenever second level help is requested in a window which is owned by this task.
Calls:	None

The actions performed by this block are as follows:-

Clear the prompt area.

Remove any outstanding 'ShowNote' messages.

When Help is requested run the task like any other application.

ON Name:	QUEUE
Function:	Programs requesting help queue to this block and set the variables S.Help.Facility, S.Help.Application, S.Help.Panel and S.Help.Box to define the level at which the Help is required and the exact subject.
Calls:	QUEUESUPPORT DETSUBJECT SETPOINTERS MAKETITLE FINDKEYS GETTEXT

The actions performed by this block are as follows:-

Queue to the Support product if active, and if successful do not provide any Help.

Surface (and show if necessary) the main window.

Clear the prompt area.

Remove any outstanding 'ShowNote' messages.

Determine Help subject.

Determine the datastore that the Help Text will be found in, and set up pointers to the relevant help tables in it.

Set up the title for the display.

Search the index in the appropriate datastore for keys to the Help Text and an optional Tutorial for the specified Help subject.

Show the 'Tutorial' box if a Tutorial is available.

Attempt to get the Help Text.

Update the display with either the retrieved help text (if there is any) or a message to indicate that no help is available.

Reset the scrolling position.

ON Name:	QUIT
Function:	This block is executed whenever a QUIT operation is performed on one of the windows owned by this task.
Calls:	None

The actions performed by this block are as follows:-

Clear the prompt area.

Remove any outstanding 'ShowNote' messages.

When 'Esc=Cancel' is selected on one of the popdowns, then hide the appropriate popdown.

ON Name: SCROLL

Function: This block is executed whenever the main help text window is scrolled.

Calls: None

The actions performed by this block are as follows:-

Clear the prompt area.

Remove any outstanding 'ShowNote' messages.

Determine how many lines of Help Text there are.

Find out how many can be displayed in the window.

Scroll the appropriate amount in the requested direction.

Limit the scrolling so that the limits of the text are not exceeded.

Put out messages if either the start or end of the text has been reached.

ON Name: SELECT

Function: This block is executed whenever a SELECT takes place in one of the windows which is owned by this task.

Calls: TEXTSELECT
TUTSELECT
EXITSELECT
REPSELECT
ACTSSELECT

The actions performed by this block are as follows:-

Clear the prompt area.

Remove any outstanding 'ShowNote' messages.

Depending on where the selection takes place, call the appropriate procedure to deal with that selection.

Selection of a word in the main text area of the main window.

Selection of the 'Tutorial' button in the main window.

A selection on the 'Exit' popdown.

A selection on the 'Reference' popdown.

A selection on the 'Output' popdown.

CX Name:	START
Function:	This block is executed when the Help application is initialised. This is done once at system startup time, by Control.
Calls:	None

The actions performed by this block are as follows:-

Enable BREAKs.

Handles for the other tasks within the application. (Set to null if task not active.) Variables used for passing data between the various tasks in the Help system.

Pointers to columns in the help index, text and text branch tables. They are set by 'SETPOINTERS' every time Help is queued to. They are set to null if not valid.

Flag set by 'QUEUESUPPORT' to indicate when the Support Help Editor has been successfully queued to.

A vector to record the names of panels changed by DeskTop.

This is the scrolling control variable for the help text displayed in the main window.

Internal system names of the facility, application, panel and box for which help has been requested.

Titles of facility, application, panel and box for which Help Text has been requested, as displayed at the top of the window. Derived from the help index table in the appropriate datastore.

Keys to the required Help Text and optionally available Tutorial.

A flag set by the 'BRANCH' procedure to indicate that an attempted branch succeeded.

Vector used for holding the required Help Text once it has been retrieved.

This is the vector which is used to display the requested Help Text in the main window.

Open panels and windows (including popdowns).

ON Name:	STOP
Function:	This block is executed whenever Help is to be quiesced or stopped. If it is queued to from within the Help application itself then Help is merely quiesced, otherwise it is stopped. Usually Help is only stopped by Control, at the end of a session.
Calls:	None

The actions performed by this block are as follows:-

If the program is to be quiesced by queueing from elsewhere within it then do that and don't stop it. Also stop the Help Map sub-task.

Otherwise the application is to be stopped (usually only when the whole system is closing down).

First, save any panels that have been changed via Desktop to the 'User' datastore.

If either Glossary, Tutorial or Help Map is active then stop them in a controlled manner (going through their TOP blocks). This is to ensure that any panels which may have been changed are saved.

Finally, stop the application level task itself.

Program Name: HELPMAP

This program consists of a number of blocks of code and procedures, as listed below

Function: This program is started as a sub-task by the 'Help' program, when a help map is to be provided.

Invocation: The starting task first sets up the following inter-task communication variables (at the application level):

A.Temp.Facility A.Temp.Application A.Temp.Panel A.Temp.Box	- Define the subject for which the help map is to be displayed. The values used are the same as those placed in the 'S.Help.' variables when Help itself is called.

Having set up these variables, the starting task just starts this program.

Once this task has been started, the 'A.Temp.' variables can be set up and this program queued

to again. This causes this program display a new help map, which is appropriate for the newly specified help subject.

Panels opened: HelpMap

ON Blocks:
BREAK
DESKTOP
ERROR
HELP
QUEUE
QUIT
SCROLL
SELECT
START
STOP

Procedures:

SETLEVELS	Set subject levels for map.
SETHEADINGS	Set titles for map levels.
SETPARENT	Set up parent level of map.
SETCHILDFACS	Set up child level, if fac's.
SETCHILDAPPS	Set up child level, if app's.
SETCHILDPANS	Set up child level, if pan's.
SETCHILDBOXS	Set up child level, if boxes.
UPDATEDISP	Refresh the whole help map.
DOWNSEL	Down arrow select handler.
UPSEL	Up arrow select handler.
PARENTSEL	Parent box select handler.
CHILDSEL	Child box select handler.

Tasks started: General.ShowErr

Input: I.Messages.Help - Translatable strings used by the whole Help application, for prompts etc.

General.Messages. General	-	Translatable strings for general use by all programs.
User input	-	From selections etc.
A.Temp.Facility, A.Temp.Application, A.Temp.Panel, A.Temp.Box	-	Define the subject for which a help map is to be displayed. Set prior to running this tasks' QUEUE or START blocks.
.HelpIndex.	-	Help index tables, which occur in DataStores which contain help text or tutorials. Used to build the help map.

Output: A screen display of a help map, which shows in a structured way most of the help text available.

Process: This program is started by the main 'Help' task as a master task. It may also be queued to by it. Prior to starting or queueing it the 'A.Temp.*' variables are set up to indicate the subject around which the help map should be drawn. The user may move round the help map and select items of help text to be displayed in the main help text window. When this is done this task queues back to the main help task to get the help text displayed.

Errors: No error should occur during normal running of this program. Any that do are unexpected, and are passed to the 'ShowErr' program as normal.

Dependencies: A help index table must be present in the system DataStore before a map can be created, as this forms the root of the map tree.

Procedure name: SETLEVELS

Function: This procedure inspects the variables 'FacName', 'AppName', 'PanName' and 'BoxName' to determine what the subject of the Help Map should be. It checks that the requested Help can be accessed from the top of the Help tree (i.e. it is not isolated). In cases where the Help for the required subject is isolated or non-existant the variables are modified to make the subject of the Help Map the next most relevent Help at a higher level. As well as checking the subject specifying variables, the procedure sets the variables 'ParentLevel' and 'ChildLevel', which determine what level of Help is displayed on each of the two levels of the map.

Parameters: No

Called by: DOWNSEL
UPSEL
ON QUEUE

Calls: None

The actions performed by this procedure are as follows:-

Set subject levels for map.

Check that the System level help is installed, and if it is not terminate the Help Map and issue an error message.

If the facility is 'System' or unspecified then system level help will

be used for the subject of the Help Map, and the appropriate levels set and checking stopped here.

Determine which datastore the Help for the specifed facility will be found. If the datastore does not exist backup to the system level.

If no Help table exists in the datastore which is supposed to contain the Help for the specified facility then revert to system level Help and erase the facility name from 'FacName' etc.

Set up indirect references to the appropriate Help index table.

If no entry for facility Help exists in the appropriate table then revert to system level Help and erase the facility name from 'FacName' etc.

If Help for the specified facility exists but there is no Help at application level, then erase all lower level references from 'AppName' etc and revert to system level for the top level of the map.

If the specified subject does not go below the facility level then stop checking here and set the appropriate levels.

If no entry for application Help exists in the appropriate table then revert to facility level Help and erase the app'n name from 'AppName' etc.

If Help for the specified app'n exists but there is no Help at panel level, then erase all lower level references from 'PanName' etc and revert to facility level for the top level of the map.

If the specified subject does not go below the app'n level then stop checking here and set the appropriate levels.

If no entry for the panel Help exists in the appropriate table then revert to app'n level Help and erase the panel name from 'PanName' etc.

If Help for the specified panel exists but there is no Help at box level, then erase all lower level references from 'BoxName' and revert to application level for the top level of the map.

If the specified subject does not go below the panel level then stop checking here and set the appropriate levels.

If no entry for the box Help exists in the appropriate table then revert to panel level Help and erase the box name from 'BoxName'.

Otherwise a valid box level subject has been specified.

Procedure name:	SETHEADINGS
Function:	This procedure sets the appropriate headings above the parent and child boxes on the panel, depending on the settings of 'ParentLevel' and 'ChildLevel'.
Parameters:	No
Called by:	UPDATEDISP
Calls:	None

The actions performed by this procedure are as follows:-

Set titles for map levels.

Procedure name:	SETPARENT
Function:	This procedure sets the appropriate title into the parent box depending on the level set for it in 'ParentLevel' and the subject of the Help Map as defined by 'FacName' etc. It also sets the uparrow if the level of the parent box is below system level.
Parameters:	No
Called by:	UPDATEDISP
Calls:	None

The actions performed by this procedure are as follows:-

Set up parent level of map.

Determine which datastore the Help in the parent box is in.

Set up indirect reference to the titles column in the appropriate help index table.

Set the parent box title.

Set the up arrow if it is valid.

Procedure name:	SETCHILDFACS
Function:	This procedure sets the titles into the child boxes when the Help to be displayed in them is at facility level. It also determines the names of the real facilities associated with each title and sets the down arrows for those facilities which have application level Help.
Parameters:	No
Called by:	UPDATEDISP
Calls:	None

The action performed by this procedure are as follows:-

Set up child level, if fac's.

Clear the temporary arrays used to hold the data for the child boxes.

For each datastore active in the system.

Ignore the system datastore.

Ignore any datastore with no help index table.

Set up indirect references to columns in the appropriate Help index table.

Search for the entry for facility level help in the datastore, and if it is not found ignore the datastore.

Get the title for the facility level help.

If title is unknown or blank ignore this datastore.

If title is a duplicate ignore this datastore.

Otherwise this datastore contains valid facility level Help. The Help title and datastore name are loaded into the appropriate vectors and the entry in the down arrows vector cleared.

If the facility has application level help below it, which has a valid title and can thus be displayed on the Help Map, then set the down arrow for it.

Finally, once the data for the child boxes has been set up in the temporary arrays, sort the temporary arrays into the final arrays for the child boxes,..

..and initialise the scrolling position.

Procedure name:	SETCHILDAPPS
Function:	This procedure sets the titles into the child boxes when the Help to be displayed in them is at application level. It also determines the names of the real applications associated with each title and sets the down arrows for those applications which have panel level Help.
Parameters:	No
Called by:	UPDATEDISP
Calls:	None

The action performed by this procedure are as follows:-

Set up child level, if app's.

Determine the datastore that the app'n Help will be found in.

Clear the temporary arrays used to hold the data for the child boxes.

Set up indirect references to the appropriate Help index table.

Find no of table entries.

For each index table entry.

If the entry is for box or panel or facility level Help ignore it.

If title is unknown or blank ignore the entry.

If title is a duplicate ignore the entry.

Otherwise just load the app'n ..and initialise the scrolling help info into the appropriate position. temporary vectors and clear the down arrows vector entry.

Then, set the down arrow entry if the app'n has panel level Help below it, which has a valid title and can thus be displayed on the Help Map.

Finally, once the data for the child boxes has been set up in the temporary arrays, sort the temporary arrays into the final arrays for the child boxes,..

..and initialise the scrolling position.

Procedure name: SETCHILDPANS

Function: This procedure sets the titles into the child boxes when the Help to be displayed in them is at panel level. It also determines the names of the real panels associated with each title and sets the down arrows for those applications which have

box level Help.

Parameters: No

Called by: UPDATEDISP

Calls: None

The actions performed by this procedure are as follows:-

Set up child level, if pan's.

Clear the temporary arrays used to hold the data for the child boxes.

Determine the datastore that the panel Help will be found in.

Set up indirect references to the appropriate Help index table.

Find no of table entries.

Find the first entry for the application in the Help index table.

For each index table entry concerning the appropriate application.

If the entry is for box or application level Help ignore it.

If title is unknown or blank ignore the entry.

If title is a duplicate ignore the entry.

Otherwise just load the panel Help info into the appropriate temporary vectors and clear the down arrows vector entry.

Then, set the down arrow entry if the panel has box level Help below it, which has a valid title and can thus be displayed on the Help Map.

Move on to the next entry in the index table if there is one.

Finally, once the data for the child boxes has been set up in the temporary arrays, sort the temporary arrays into the final arrays for

the child boxes,..

..and initialise the scrolling position.

Procedure name:	SETCHILDBOXS
Function:	This procedure sets the titles into the child boxes when the Help to be displayed in them is at box level. It also determines the names of the real boxes associated with each title and clears the down arrows.
Parameters:	No
Called by:	UPDATEDISP
Calls:	None

The actions performed by this procedure are as follows:-

Set up child level, if boxes.

Clear the temporary arrays used to hold the data for the child boxes.

Determine the datastore that the box Help will be found in.

Set up indirect references to the appropriate Help index table.

Find no of table entries.

Find the position of the first box in the index table.

For each index table entry concerning boxes on the appropriate panel.

If title is unknown or blank ignore the entry.

If title is a duplicate ignore the entry.

Otherwise just load the box Help info into the appropriate temporary vectors and clear the down arrows vector.

Move on to the next entry in the index table if there is one.

Finally, once the data for the child boxes has been set up in the temporary arrays, sort the temporary arrays into the final arrays for the child boxes,..

..and initialise the scrolling position.

Procedure name:	UPDATEDISP
Function:	This procedure updates the Help Map display.
Parameters:	No
Called by:	DOWNSEL
	UPSEL
	ON QUEUE
Calls:	SETHEADINGS
	SETPARENT
	SETCHILDFACS
	SETCHILDAPPS
	SETCHILDPANS
	SETCHILDBOXS

The actions performed by this procedure are as follows:-

Refresh the whole help map.

Set the headings above the parent and child boxes.

Set up the parent box and up arrow.

Set up the child boxes and down arrows (using an appropriate procedure for the level of the child box contents).

Procedure name:	DOWNSEL
Function:	This procedure is called whenever a down arrow is selected. It sets the subject defining variables to give the appropriate next level of help down and refreshes the Help Map.
Parameters:	No
Called by:	ON SELECT

Calls: SETLEVELS
UPDATEDISP

The actions performed by this procedure are as follows:-

Down arrow select handler. Check that the down arrow is valid.

Then, depending on the current child level set the subject defining variables to indicate the next level down..

..and refresh the map.

Procedure name: UPSEL
Function: This procedure is called whenever the up arrow is selected. It sets the subject defining variables to give the next level of help up and refreshes the Help Map.
Parameters: No
Called by: ON SELECT
Calls: SETLEVELS
UPDATEDISP

The actions performed by this procedure are as follows:-

Up arrow select handler.

Check that the up arrow is valid.

Then, depending on the current parent level set the subject defining variables to indicate the next level up..

..and refresh the map.

Procedure name: PARENTSEL
Function: This procedure is called whenever the parent box on the Help Map is selected. It queues to the Help master task with a request to display the

Help Text for the subject which corresponds to the parent title.

Parameters: No
Called by: ON SELECT
Calls: None

The actions performed by this procedure are as follows:-

Parent box select handler.

Depending on the level of the parent box set the appropriate data into the variables which are normally set before queueing Help,..

..and queue to the Help application just like a normal request.

Procedure name: CHILDSEL
Function: This procedure is called whenever a child box on the Help Map is selected. It queues to the Help master task with a request to display the Help Text for the subject which corresponds to the child title.
Parameters: No
Called by: ON SELECT
Calls: None

The actions performed by this procedure are as follows:-

Child box select handler.

Check that the child box has a valid title in it.

Depending on the level of the child boxes set the appropriate data into the variables which are normally set before queueing Help,..

..and queue to the Help application just like a normal request.

ON Name: BREAK

Function: This block is executed whenever a BREAK occurs whilst this task is running. This only occurs during the ON START block, and causes this task to stop. BREAKs are not allowed anywhere else, as there are no slow operations.

Calls: None

The actions performed by this block are as follows:-

Flag the Help Map as stopped, and stop.

ON Name: DESKTOP

Function: This block is executed whenever a desktop operation is performed in a window which is owned by this task.

Calls: None

The actions performed by this block is as follows:-

If the panel is changed via DeskTop then record the fact so that it can be saved away when the subtask is stopped.

ON Name: ERROR

Function: This block is called whenever an execution error occurs whilst this program is running.
The 'ShowErr' program is started to provide some diagnostic information for debugging purposes, as is standard practice. No errors should occur during normal operation of this program, thus no attempt is made to trap or handle any.

Calls: None

The action performed by this block is as follows:-

For debugging purposes.

ON Name: HELP

Function: This block is executed whenever second level help is requested in a window which is owned by this task.

Calls: None.

The action performed by this block is as follows:-

When help is requested just run the task like any other application.

ON Name: QUEUE

Function: Tasks queue to this block to refresh the Help Map so that it is set up for a particular subject. It determines the level of help to be shown on each of the two levels of the map and the specific subject around which the map should be based.

Calls: SETLEVELS

The actions performed by this block are as follows:-

Determine the intended subject of the help map (these must never become unknown). The 'A.Temp.' variables are always cleared after usage.

Determine the levels of help to be displayed at each of the map levels. Update the map display with the info for the appropriate levels and subject.

Surface the window.

ON Name: QUIT

Function: This block is executed whenever a QUIT operation is performed on one of the windows owned by this task.

Calls: None

The action performend by this block is as follows:-

When 'Esc=Cancel' is selected terminate the task.

ON Name: SCROLL

Function: This block is executed whenever the help map window is scrolled.

Calls: None

The actions performed by this block are as follows:-

Determine how many child titles there are.

Find out how many can be displayed in the window.

Scroll the appropriate amount in the requested direction.

Limit the scrolling to ensure that the ends of the data are not exceeded and hide and show the boxes which indicate if there is more data in either direction.

ON Name: SELECT

Function: This block is executed whenever a SELECT takes place in one of the windows which is owned by this task.

Calls: UPSEL
DOWNSEL
PARENTSEL
CHILDSEL

The action performed by this block is as follows:-

Depending on where the select takes place on the Help Map, call an appropriate procedure to deal with it.

ON Name: START

Function: This block is executed when the Help Map part of the help application is started. This is usually when the 'Help Map' button on the main help text 'Reference' pull-down has been selected.

Calls: None

The actions performed by this block are as follows:-

Enable BREAKs.

This is the scrolling control variable for the child boxes on the help map.

Flag to record if the panel has been changed via 'DeskTop'.

Internal system names of the facility, application, panel and box for which a Help Map has been requested.

Level of help for each of the two levels of the help map. (May be 'System', 'Facility', 'Application', 'Panel', or 'Box'.)

The titles of the help at the higher and lower levels of the Help Map, as displayed in the appropriate boxes.

The real names of the entities whose titles are displayed in the child boxes.

The arrows that indicate if the user can move up or down the map from a given item.

Open panel and window.

Queue to the 'ON QUEUE' block to refresh the display.

ON Name:	STOP
Function:	This block is executed whenever the program is to be stopped. This is usually by queueing from elsewhere within it, e.g. from the code which handles the 'Esc=Quit' button.
Calls:	None

The actions performed by this block are as follows:-

When stopping..

..save the panel if it has been changed via DeskTop,..

..flag the Help Map as stopped,..

..and stop.

We claim:

1. A data processing system comprising:

means for displaying panels of information relating to at least one task, the panels being viewable through at least one window;

operator input means for providing interactive communication with the system including means for identifying the displayed information including a visible indicator, viewable on said display means for identifying selectable information;

means for communicating, associated with said visible indicator, an operator selection to the system and, for requesting help information from the system;

an addressable store of hierarchical help text information;

contextual help means responsive to a request for help and to a current state of the system, defined by plural system state variables, to access the help text store and obtain appropriate help text and display said help text through one of said windows, said system state variables being ranked based on the current system state, and hierarchical help text information having corresponding help text is displayed such that specific system state variables are associated with low order help text and often system state variables are associated with high order help text;

help map display means for displaying in a separate window, concurrently with said help text and information relating to the at least one task, at least a portion of a hierarchical map of the stored help text corresponding to a current one of the system state variables; and

means for replacing the help text in the help text window with help text corresponding to the a selected entry from said help map.

2. A system according to claim 1 wherein said system variables are applied as addressing information to a key table to produce a key which is an address for accessing a unit of help text in said help text store.

3. A system according to claim 2 wherein said system variables comprise:

a panel order of help text, corresponding to the displayed panel of information in which said indicator is located;

a low order system state variable, associated with said low order help text, that corresponds to the location of the indicator within a predefined box in the displayed panel of information;

a high order system state variable, associated with said high order help text, that corresponds to a program application responsible for displaying the panel of information; and

a facility order of help text that has a higher system state variable than said high order system state variable.

4. A system according to claim 3 wherein said help map display means comprises selectively operable branching means for causing display of a new help map after selection of a branching function for a given map entry that is a low order system state variable or high order system state variable.

5. A system according to claim 4 wherein said displayed map entries comprise icons, indicating the permitted direction of branching, selectable by the operator via said operator input means when said visible indicator is positioned on one of said icons.

6. A system according to claim 5 further comprising help text branching means, responsive to the selection of selectable branch words included within the body of said help text being currently displayed, for accessing related help text in the help text store, for replacing the original help text with said related help text, and for displaying said related help text.

7. A system according to claim 6 further comprising a glossary store wherein selection of a help text word, other than said selectable branch words, cases display of a glossary window containing a definition of the selected word or the alphabetically nearest words.

8. A method of presenting help information in a data processing system, comprising:

displaying panels, viewable through a window, of information relating to at least one task;

providing interactive operator communication with said data processing system,

providing an addressable store of hierarchical help text information by identifying items displayed on a screen of a display within said data processing system by selecting said items with a variable indicator, communicating the operator selected items to the data processing system and requesting help information from the dnta processing system;

obtaining and displaying appropriate help text from said addressable store;

concurrently displaying said appropriate help text, the information relating to the at least one task and at least a portion of a hierarchical help map, corresponding to a current state of said system as defined by plural system state variables, said system state variables being ranked based on the current system state and hierarchical help text information, associ-

ated with said hierarchical help map, having corresponding help text displayed such that specific system state variables are associated with low order help text and other system state variables are associated with high order help text; and

replacing the help text currently displayed with help text corresponding to a selected entry from said hierarchical help map.

9. A method according to claim 8 wherein said step of concurrently displaying help text, comprises addressing a key table using said system state variables to produce a key which is an address for accessing a unit of help text in said help text store.

10. A method according to claim 9 wherein said step of concurrently displaying system state variables comprises:

displaying a panel order of help text, corresponding to the displayed panel of information in which said indicator is located;

displaying a low order system state variable, associated with said low order help text, that corresponds to the location of the indicator within a predetermined box in the displayed panel of information;

displaying a high order system state variable, associated with said high order help text, that corresponds to a program application responsible for displaying the panel of information; and

displaying a facility order to help text that has a higher system state variable than said high order system state variable.

11. A method according to claim 10 wherein said step of providing interactive operator communications, comprises causing display of a new help map after section of a branching function for a given map entry that is a low order system state variable or high order system state variable.

12. A method according to claim 11 wherein said step of concurrently displaying said help text comprises displaying icons, indicating the permitted direction of branching, selectable by the operator when said visible indicator is positioned on one of said icons.

13. A method according to claim 12 further comprising:

accessing related help text in the help text store;

replacing the original help text with said related help text; and

displaying said related help text.

14. A method according to claim 13 further comprising providing a glossary store wherein selection of a help text word, other than said selectable branch words causes display of a glossary window containing a definition of the selected word or the alphabetically nearest words.

15. A computer program implanted on a data processing system and for controlling said data processing system to display help information to a user of said system, comprising:

means for displaying panels, viewable through a window, of information relating to at least one task;

interactive operator communication means for providing operator input to said data processing system to identify items displayed on a display screen within said data processing system by selecting said display items, to communicate the selected items to said data processing system and for requesting help information from the data processing system;

an addressable store of hierarchical help text information;

means for obtaining and displaying appropriate help text from said addressable store;

means for concurrently displaying said appropriate help text, information relating to the at least one task and at least a portion of a hierarchical help map, corresponding to a current state of said system as defined by plural system state variables, said system state variables being ranked based on the current system state and hierarchical help text information having corresponding help text is displayed such that specific system state variables are associated with low order help text and specific system state variables are associated with high order help text; and

means for replacing the help text currently displayed with help text corresponding to a selected entry from said hierarchical help map.

16. A computer program according to claim 15 wherein said means for concurrently displaying help text, comprises means for addressing a key table using said system state variables to produce a key which is an address for accessing a unit of help text in said help text store.

17. A computer program according to claim 16 wherein said means for concurrently displaying system state variables comprises:

means for displaying a panel order to help text, corresponding to the displayed pane of information in which said indicator is located;

means for displaying a low order system state variable, associated with said low order help text, that corresponds to the location of the indicator within a predetermined box in the displayed panel of information;

means for displaying a high order system state variable, associated with said high order help text, that correspond to a program application responsible for displaying the panel of information; and

means for displaying a facility order of help text that has a higher system state variable than said high order system state variable.

18. A computer program according to claim 17 wherein said interactive operator communication means, comprises means for causing display of a new help map after selection of a branching function for a given map entry that is a low order system state variable or high order system state variable.

19. A computer program according to claim 18 wherein said means for concurrently displaying said help text comprises means for displaying icons, that indicate the permitted direction of branching, said icons being selectable by an operator when said visible indicator is positioned on one of said icons.

20. A computer program according to claim 19 further comprising:

means for accessing related help text in the help text store;

means for replacing the original help text with said related help text; and

means for displaying said related help text.

21. A computer program according to claim 20 further comprising a glossary store wherein selection of a help text word, other than said selectable branch words causes display of a glossary window containing a definition of the selected word or the alphabetically nearest words.

* * * * *

US005179654C1

(12) REEXAMINATION CERTIFICATE (4339th)

United States Patent
Richards et al.

(10) Number: US 5,179,654 C1
(45) Certificate Issued: *May 8, 2001

(54) **HELP PROVISION IN A DATA PROCESSING SYSTEM**

(75) Inventors: **Justin J. C. Richards**, Warwick; **Kenneth Williams**, Leamington Spa, both of (GB)

(73) Assignee: **International Business Machines Corporation**, Armonk, NY (US)

Reexamination Request:
No. 90/004,237, May 3, 1996

Reexamination Certificate for:
Patent No.: **5,179,654**
Issued: **Jan. 12, 1993**
Appl. No.: **07/790,840**
Filed: **Nov. 12, 1991**

(*) Notice: This patent is subject to a terminal disclaimer.

Related U.S. Application Data

(63) Continuation of application No. 07/469,549, filed on Mar. 20, 1990, now Pat. No. 5,122,972.

(51) **Int. Cl.**[7] **G06F 17/60**

(52) **U.S. Cl.** **345/338**; 345/340; 345/348

(58) **Field of Search** 395/157, 160, 395/353, 155, 156, 158, 161, 336–346, 352–357; 345/336–346, 352–357

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,430,725	2/1984	Elliott et al.	395/772
4,434,475	2/1984	McCaskill et al.	395/352
4,435,777	3/1984	McCaskill et al.	395/793
4,451,900	5/1984	Mayer et al.	395/789
4,459,678	7/1984	McCaskill et al.	395/326
4,507,753	3/1985	McCaskill et al.	395/769
4,521,851	6/1985	Trubisky et al.	395/394
4,556,954	12/1985	Advani et al.	395/761
4,618,858	10/1986	Belch	395/342 X
4,622,013 *	11/1986	Cerchio	434/118

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

1278103	12/1990	(CA).
1291272	10/1991	(CA).
1306066	8/1992	(CA).
0 056 886 *	1/1981	(EP).
056-886	8/1982	(EP).
63-103371	5/1988	(JP).

OTHER PUBLICATIONS

Helander (ed.),Handbook of Human–Computer Interaction, 1988, p. xvii–xxxiii, 123–133, 345–364, 413–436.*

Sondheimer, Human Factors and User Assistance in Interactive Computing Systems: An Introduction, IEEE Transactions on Systems, Man and Cybernetics,v.SMC–12, n.2. Mar./Apr. 1982, p. 102–107.*

Fenchel, Self Describing Systems Using Integral Help, IEEE Transactions on Systems, Man and Cybernetics, v.SMC–12, n.2. Mar./Apr. 1982, p. 162–167.*

Barrett (ed.), Text, Context and Hypertext, 1987, p. 301–306.*

American Management Systems, Directory Shell User Manual, Dec. 1986.*

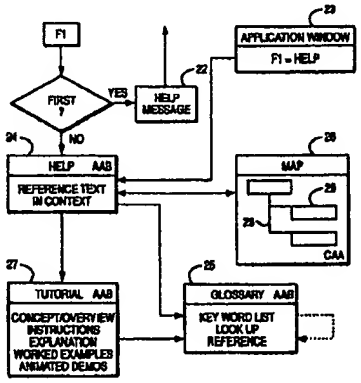
Kearsley et al., Designing Interactive Software, 1985, p. 62–70.*

(List continued on next page.)

Primary Examiner—Anton W Fetting

(57) **ABSTRACT**

Help is provided to the user of a data processing system having a work station, including a display, and input means including a visible on-screen indicator and a selection means, in response to a request from the user, information on the current state of the system is used to address a store of hierarchical help text information, thereby providing contextual help text which is displayed in a separate window on the display screen alongside information related to the task in hand. A help map function is available which displays concurrently, separately from the help text, a portion of a hierarchical map of the stored help text to be replaced by new help text corresponding to the selected map entry.



U.S. PATENT DOCUMENTS

4,642,790		2/1987	Minshull et al.	395/341
4,686,522		8/1987	Hernandez et al.	395/347 X
4,688,167		8/1987	Agarwal	395/343
4,752,889		6/1988	Rappaport et al.	395/12
4,772,882		9/1988	Mical	395/347 X
4,779,080		10/1988	Coughlin et al.	395/352 X
4,783,759		11/1988	Borgendale et al.	395/347
4,791,556		12/1988	Vilkaitis	395/348
4,821,211	*	4/1989	Torres	395/353
4,823,283		4/1989	Diehm et al.	395/352
4,845,644		7/1989	Anthias et al.	395/343
4,965,741	*	10/1990	Winchell et al.	395/12
4,992,972	*	2/1991	Brooks et al.	395/155
5,086,513		2/1992	Lawrence et al.	455/186.1
5,109,433		4/1992	Notenboom	382/240
5,157,768		10/1992	Hoeber et al.	395/338
5,201,047	*	4/1993	Maki et al.	395/600
5,241,671	*	8/1993	Reed et al.	395/600
5,287,448		2/1994	Nicol et al.	395/337

OTHER PUBLICATIONS

Soucie, Corporate Consolidation, PC World,Oct. 1987, p. 170–177.*

Gries, Compiler Construction for Digital Computers, 1971, p. 175–178.*

Charland, The Application System 400 Help Facility—Design Philosophy and Considerations, IBM Systems Journal, p. 424–442,1989.*

Carroll et al., Interface Design Issues for Advice–Giving Expert Systems, Communications of the ACM, v.30,n.1, p. 14–31, Jan. 1987.*

Houghton,Jr., Online Help Systems: A Conspectus, Communications of the ACM, v.27,n.2, p. 126–133, Feb. 1984.*

Foley et al., Fundamentals of Interactive Computer Graphics, p. 184–186, 234–239, 1984.*

Good et al., Building a User Derived Interface, Communications of the ACM, v.27,n.10, p. 1032–1043, Oct. 1984.*

Stefik et al., Beyond the Chalkboard: Computer Support for Collaboration and Problem Solving in Meetings, Communications of the ACM, v.30,n.1, p.32–47, Jan. 1987.*

Harel, On Visual Formalism, Communications of the ACM, v.31,n.5, p.514–530, May 1988.*

Carroll et al., Training Wheels in a User Interface, Communications of the ACM, v.27,n.8, p.800–806, Aug. 1984.*

Brown et al., Converting Help Systems to Hypertext, Software–Practice and Experience, v.18(2),p. 163–165, Feb. 1988.*

Ferranti, IBM Adds Polish to Platinum Line With New Interface, PC Week, v.7, n.11, p.12, Mar. 19, 1990.*

W.K. English, D.C. Engel bart & M.L. Berman, Display–Selection Techniques for Text Manipulation, IEEE Transactions on Human Factors in Electronics, vol. HFE–8, No. 1 (Mar. 1967).

David Gries, *Compiler Construction for Digital Computers* (1971).

Daniel Carl Swinehart, Copilot: A Multiple Process Approach to Interactive Programming Systems, Stanford Artificial Intelligence Laboratory Report (Jul. 1974).

Alan Kay and Adele Goldberg, *Personal Dynamic Media* (Mar. 1977).

Alan Borning, The Programming Language Aspects of ThingLab, a Constraint–Oriented Simulation Laboratory in ACM Transactions on Programming Languages and Systems, vol. 3, No. 4 (Oct. 1981).

N.K. Sondheimer and N. Relles, Human Factors and User Assistance in Interactive Computing Systems: An Introduction, IEEE Transactions on Systems, Man, and Cybernetics, vol. SMC–12, No. 2, p. 102 (Mar./Apr. 1982).

R. S. Fenchel and G. Estrin, Self–Describing Systems Using Integral Help, IEEE Transactions on Systems, Man, and Cybernetic, vol. SMC–12 No. 2, p. 162 (Mar./Apr. 1982).

Greg Kearsley & Robin Halley, *Designing Interactive Software,* pp. 63–69 (1985).

American Management Systems, Inc., Departmental Systems Group Directory Shell, Version 1.38 (user manual (Dec. 1986).

FASTAR and Control/PC head to head, PC World, p. 176 (Oct. 1987).

New DAC–Easy Word II (advertisement), PC World (Oct. 1987).

WordTech Systems, Inc., dBXL (advertisement), PC World, p. 125 (1987).

Patricia A. Billingsley, Taking Panes: Issues in the Design of Windowing Systems in Handbook of Human–Computer Interaction, pp. 413–415 (M. Helander ed., 1988).

Philip Rubens and Robert Krull, Designing Online Information in Text, Context, and Hypertest; Writing with and for the Computer, pp. 301–306 (E. Barrett ed., 1988).

Elkerton, Online Aiding for Human–Computer Interfaces in Handbook of Human–Computer Interaction, pp. 345–364 (M. Helander ed.., 1988).

J.E. Ziegler and K.P. Fahnrich, Direct Manipulation in Handbook of Human–Computer Interaction, pp. 123–129 (M. Helander ed., 1988).

Geri Younggren, Using Object Oriented Programming Language to Create Audience–Driven Hypermedia Environments in Text, Context, and Hypertext: Writing with and for the Computer, pp. 80–82 (E. Barretted., 1988).

D. A. Charland, The Application System/400 help facility—design philosophy and considerations, IBM Systems Journal vol. 28, No. 3 (1989).

J. Nielsen, Multimedia and Hypertext: The Internet and Beyond (1995).

Adele Goldberg and David Robson, *A Metaphor for Under Interface Design,* Xerox Palo Alto Research Center Learning Research Group.

IBM Technical Disclosure Bulletin, Online Assistance, vol. 28, No. 6, Nov., 1985, pp. 2293–2294.

Clifford Burgess, UNIX and ADA—Local Area Networks, Helping Users Use Unix, Computers and Industrial Engineering, vol. 15, pp. 244–248 (1988).

N. Paz, W. Leigh and R. Yim, Using Graphical Study Trees to Present HELP Knowledge, Microcomputers for Information Management, Mar., 1989, pp. 47–67.

* cited by examiner

REEXAMINATION CERTIFICATE ISSUED UNDER 35 U.S.C. 307

NO AMENDMENTS HAVE BEEN MADE TO THE PATENT

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

The patentability of claims 1–21 is confirmed.

* * * * *

APPENDIX E: Copy of Palmer et al U.S. Patent No. 6,320,588

US006320588B1

(12) **United States Patent**
Palmer et al.

(10) **Patent No.: US 6,320,588 B1**
(45) **Date of Patent: Nov. 20, 2001**

(54) **AUDIO/VIDEO STORAGE AND RETRIEVAL FOR MULTIMEDIA WORKSTATIONS**

(75) Inventors: **Larry G. Palmer; Ricky S. Palmer**, both of Nashua, NH (US)

(73) Assignee: **Compaq Computer Corporation**, Houston, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **08/844,688**

(22) Filed: **Apr. 18, 1997**

Related U.S. Application Data

(63) Continuation of application No. 07/915,088, filed on Jul. 16, 1992, now Pat. No. 5,623,690, which is a continuation-in-part of application No. 07/893,074, filed on Jun. 3, 1992, and a continuation-in-part of application No. 07/893,234, filed on Jun. 3, 1992.

(51) **Int. Cl.**[7] **G06F 17/00**

(52) **U.S. Cl.** **345/473**; 707/101; 707/102; 345/475; 725/109; 725/110

(58) **Field of Search** 707/1–540; 345/330, 345/333, 334, 473; 348/484–515, 473; 709/200–212; 725/109–110

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,584,142	6/1971	Schoeffler	178/6.8
4,387,271	6/1983	Artom	179/2 DP
4,516,156	5/1985	Fabris et al.	358/85
4,525,779	6/1985	Davids et al.	364/200
4,574,374	3/1986	Scordo	370/62
4,587,651	5/1986	Nelson et al.	370/88
4,645,872	2/1987	Pressman et al.	379/54

(List continued on next page.)

OTHER PUBLICATIONS

Dineen, The Under Secretary of Defense, Protocols: OSDIR-1.TXT, DARPA/DCA, Dec. 23, 1978.*
Department of Defense, Internet Protocol, Jan. 1980.*
Department of Defense, Transmission Control Protocol, Jan. 1980.*
Jeffay, et al., "System Design for Workstation-Based Conferencing with Digital Audio and Video," *IEEE CH2955*, pp. 169–177 (Mar. 1991).

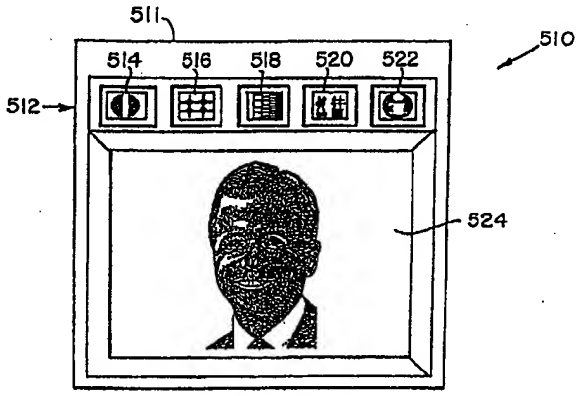
(List continued on next page.)

Primary Examiner—Wayne Amsbury
Assistant Examiner—David Jung
(74) *Attorney, Agent, or Firm*—Hamilton, Brook, Smith & Reynolds, P.C.

(57) **ABSTRACT**

An apparatus and method for storing and retrieving synchronized audio/video "filmclips" to and from a data file of a multimedia computer workstation includes a storage means for a workstation to store audio and video data as digital data packets to the data file, and retrieval means for the workstation to retrieve audio and video data from the data file. The video data is presented as an image on the display of the workstation, while the audio data is sent to either amplified speakers or headphones. An audio data stream is stored to the data file such that the audio data can be retrieved from the data file and reconstructed into a continuous audio signal. The video data is stored to the data file such that each frame of video data is inserted into the stored audio data stream without affecting the continuity of the audio signal reconstructed by the workstation. Timing information is attached to each frame of video data stored to the file, and indicates a point in the continuous audio data stream which corresponds in time to the frame of video data. A synchronizer displays a frame of video data when the point in the audio data stream, corresponding to the timing information of the retrieved video frame is audibly reproduced by the workstation. The invention also features a video teleconferencing "answering machine" which allows a user to leave an audio/video "filmclip" message on another workstation.

40 Claims, 33 Drawing Sheets



U.S. PATENT DOCUMENTS

4,650,929	3/1987	Boerger et al.	358/86
4,653,090	3/1987	Hayden	379/204
4,679,191	7/1987	Nelson et al.	370/84
4,686,698	8/1987	Tompkins et al.	379/53
4,710,917	12/1987	Tompkins et al.	370/62
4,734,765	3/1988	Okada et al.	358/102
4,748,618	5/1988	Brown et al.	370/94
4,827,339	5/1989	Wada et al.	358/136
4,847,829	7/1989	Tompkins et al.	370/62
4,849,811	7/1989	Kleinerman	358/133
4,882,743	11/1989	Mahmoud	379/53
4,888,795	12/1989	Ando et al.	379/53
4,893,326	1/1990	Duran et al.	379/53
4,897,866	1/1990	Majmudar et al.	379/94
4,905,231	2/1990	Leung et al.	370/94.1
4,918,718	4/1990	Emmons et al.	379/53
4,924,311	5/1990	Ohki et al.	358/138
4,932,047	6/1990	Emmons et al.	379/53
4,935,953	6/1990	Appel et al.	379/53
4,942,540	7/1990	Black et al.	364/514
4,943,994	7/1990	Ohtsuka et al.	379/53
4,949,169	8/1990	Lumelsky et al.	358/86
4,953,159	8/1990	Hayden et al.	370/62
4,953,196	8/1990	Ishikawa et al.	379/53
4,962,521	10/1990	Komatsu et al.	379/53
4,965,819	10/1990	Kannes	379/53
4,995,071	2/1991	Weber et al.	379/53
5,003,532	3/1991	Ashida et al.	370/62
5,034,916	7/1991	Ordish	364/900
5,042,006	8/1991	Flohrer	364/900
5,042,062	8/1991	Lee et al.	379/54
5,046,079	9/1991	Hashimoto	379/53
5,046,080	9/1991	Lee et al.	379/73
5,056,136	10/1991	Smith	389/10
5,062,136	10/1991	Gattis et al.	380/18
5,072,442	12/1991	Todd	370/62
5,079,627	1/1992	Filo	358/85
5,099,510	3/1992	Blinken, Jr. et al.	379/202
5,103,444	4/1992	Leung et al.	370/60
5,111,409	5/1992	Gasper et al.	395/152
5,113,431	5/1992	Horn	379/94
5,195,086	3/1993	Baumgartner et al.	379/202
5,195,134 *	3/1993	Inoue	348/473
5,200,989	4/1993	Milone	379/96
5,283,561	2/1994	Lumelsky et al.	340/271
5,339,392 *	8/1994	Risberg et al.	345/333
5,375,068	12/1994	Palmer et al.	364/514
5,432,525	7/1995	Maruo et al.	345/2

OTHER PUBLICATIONS

Palmer and Palmer, "Desktop Meeting", *LAN Magazine,* 6(11):111–121 (Nov. 1991).

D. Comer, "Internetworking with TCP/IP, vol. I: Principles, Protocols, and Architecture", 2nd Edition, pp. 1–8, 337–346, 505 (Prentice Hall: Englewood Cliffs, New Jersey 1991).

S.E. Minzer, "New Directions in Signaling for Broadband ISDN," *IEEE Communications Magazine,* pp. 6–14 (Feb. 1989).

L.F. Ludwig, "Integration of CAD/CAE with Multimedia Teleconferencing and Messaging Via Broadband Networks and Shared Resource Servers," *Systems Integration '90,* Proceeding of the First International Conference on Systems Integration, pp. 136–143 (1990).

Liebhold, M., et al., "Digital Multimedia Systems," *Communications of the ACM,* 34(4):104–112 (Apr., 1991).

Rangan, P.V., et al., "Software Architecture for Integration of Video Services in the Etherphone System," *IEEE Journal on Selected Areas in Communications,* vol. 9(9):1395–1404 (Dec. 1991).

Jeffay, K, et al., "Kernel Support for Live Digital Audio and Video," University of North Carolina at Chapel Hill, Department of Computer Science, Chapel Hill, NC USA 27599–3175, pp. 11–21 (Jul., Aug. 1992).

Wolfiner, B., et al., "A Continuous Media Data Transport Service and Protocol for Real–Time Communication in High Speed Networks," The Tenet Group, Computer Science Division, Dept. of EECS, University of California, Berkeley and International Computer Science Institute, Berkeley, CA 94720, USA, pp. 172–182 (Nov. 1991).

Weiss, C., "Desk Top Video Conferencing—An Important Feature of Future Visual Communications," *IEEE,* CH2829, pp. 0134–0139 (1990).

Aguilar, L., et al., "Architecture for a Multimedia Teleconferencing System," Information Sciences and Technology Center, SRI International, Menlo Park, CA 94025, pp. 126–136 (1986).

Anderson, D., et al., "Support for Continuous Media in the Dash System," Computer Science Division, Department of Electrical Engineering and Computer Science, University of California, Berkeley, Berkeley, CA 94720, pp. 54–61 (1990).

Anderson, D, et al., "First International Workshop on Network and Operating System Support for digital Audio and Video," TR–90–062, *International Computer Science Institute (ICSI),* Berkeley, CA (Nov. 8–9, 1990).

Leydekkers, P., et al., "Synchronization of Multimedia Data Streams in Open Distributed Environments," *Network and Operating System Support for Digital Audio and Video, Second International Workshop,* Heidelberg, Germany, pp. 94–107 (Nov. 1991).

Frey, S., et al., "An Application Framework for Multimedia Communication," *Network and Operating System Support for Digital Audio and Video, Second International Workshop,* Heidelberg, Germany, pp. 255–264 (Nov. 1991).

Anderson, D., et al., "Toolkit Support for Multiuser Audio/Video Applications," *Network and Operating System Support for Digital Audio and Video, Second International Workshop,* Heidelberg, Germany, pp. 231–241 (Oct. 25, 1991).

Blakowski, G., et al., "Tools for Specifying and Executing Synchronized Multimedia Presentations," *Network and Operating System Support for Digital Audio and Video, Second International Workshop,* Heidelberg, Germany, pp. 272–282 (Nov. 1991).

Meissner, K., "Architectural Aspects of Multimedia CD–I Integration in UNIX / X–Windows Workstations," *Network and Operating System Support for Digital Audio and Video, Second International Workshop,* Heidelberg, Germany, pp. 314–327 (Nov. 1991).

* cited by examiner

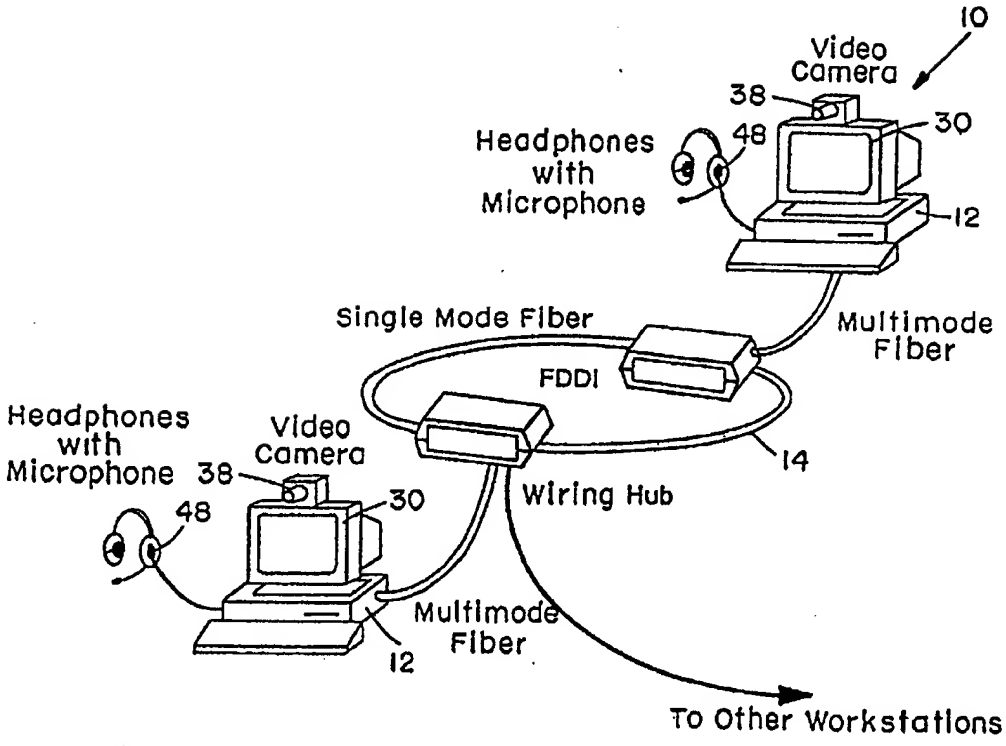

10
Video Camera
38
30
48
Headphones with Microphone
12
Single Mode Fiber
Multimode Fiber
FDDI
14
Wiring Hub
Headphones with Microphone
Video Camera
38
30
48
Multimode Fiber
12
To Other Workstations

FIG. 1

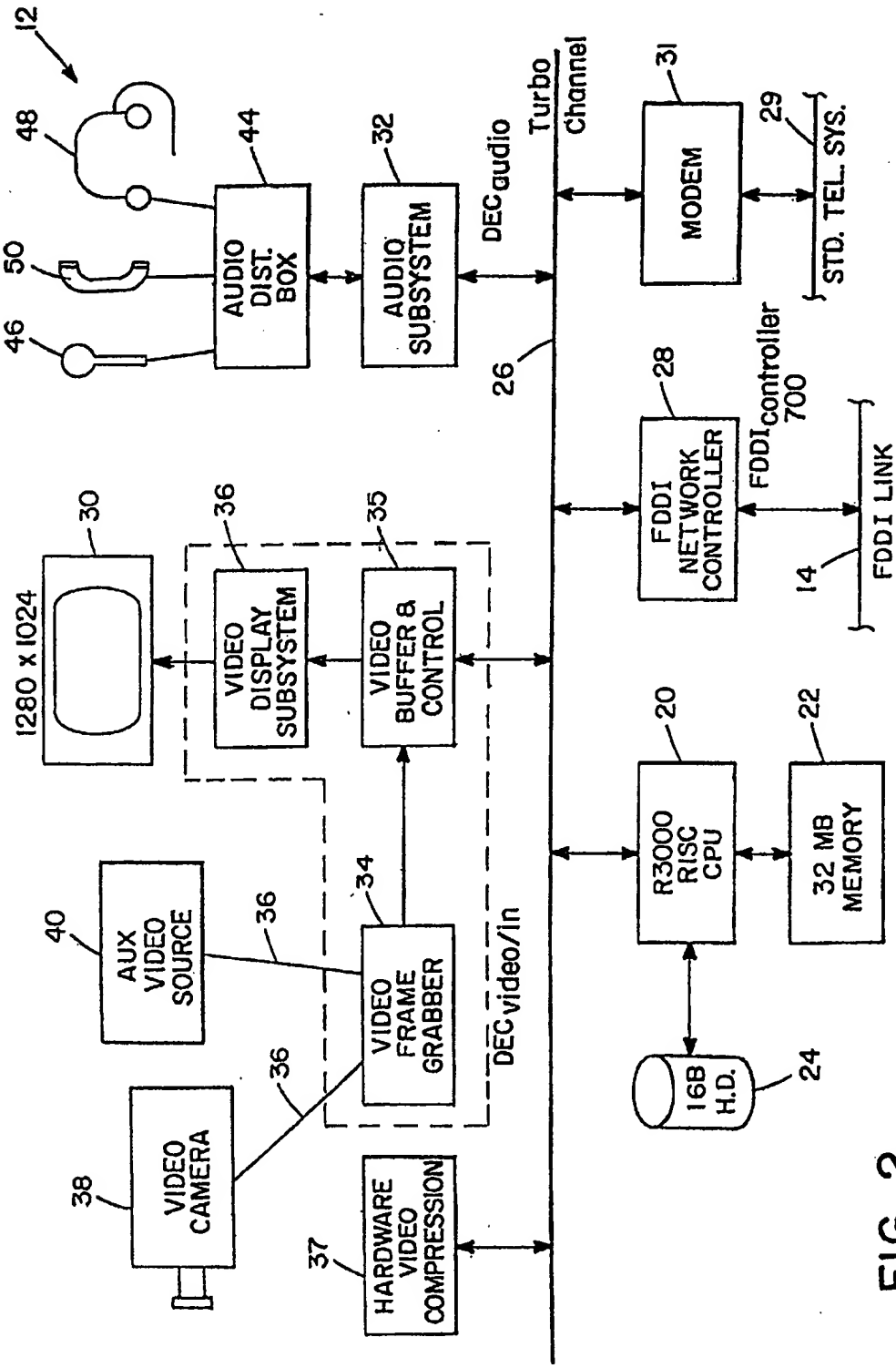

12
48
50
46
AUDIO DIST. BOX
44
AUDIO SUBSYSTEM
32
DEC audio
Turbo Channel
MODEM
31
29
STD. TEL. SYS.
26
FDDI NETWORK CONTROLLER
28
FDDI controller 700
FDDI LINK
14
1280 x 1024
30
VIDEO DISPLAY SUBSYSTEM
36
VIDEO BUFFER & CONTROL
35
AUX VIDEO SOURCE
40
VIDEO FRAME GRABBER
34
VIDEO CAMERA
38
HARDWARE VIDEO COMPRESSION
37
DEC video/in
R3000 RISC CPU
20
32 MB MEMORY
22
16B H.D.
24

FIG. 2

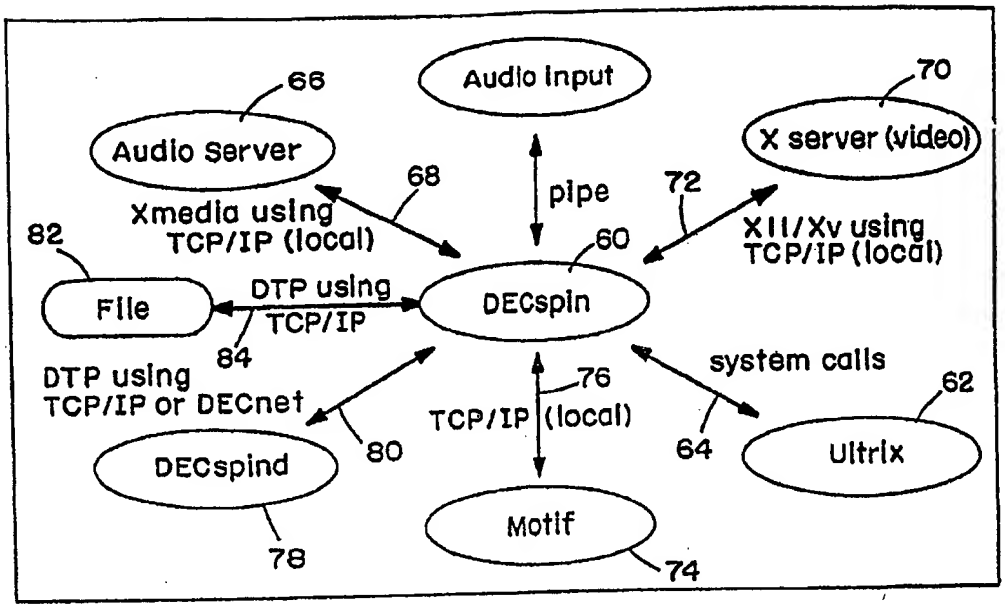

Audio Input
66
Audio Server
70
X server (video)
68
pipe
72
Xmedia using
TCP/IP (local)
X11/Xv using
TCP/IP (local)
82
60
File
DTP using
TCP/IP
DECspin
84
DTP using
TCP/IP or DECnet
76
system calls
62
TCP/IP (local)
80
64
DECspind
Ultrix
Motif
78
74

FIG. 3

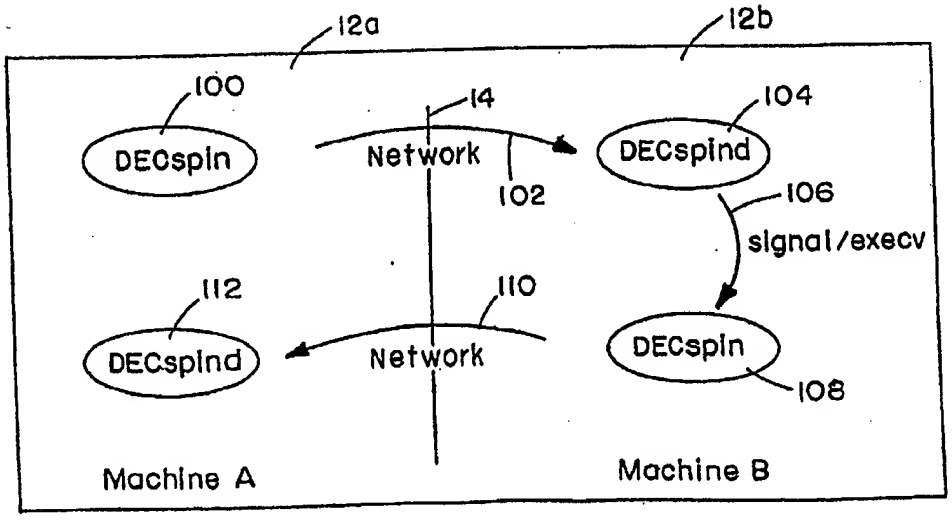

12a
12b
100
14
104
DECspin
Network
DECspind
102
106
signal/execv
112
110
DECspind
Network
DECspin
108
Machine A
Machine B

FIG. 4

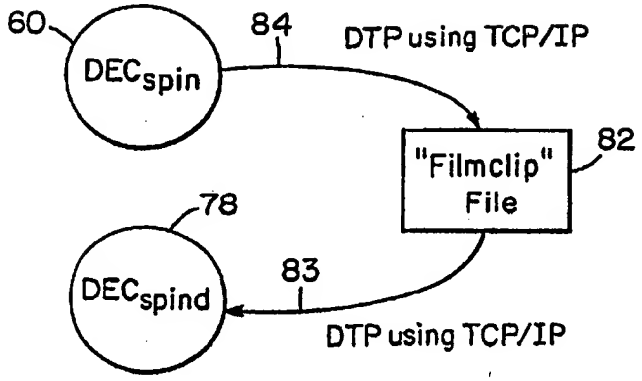


FIG. 3(a)

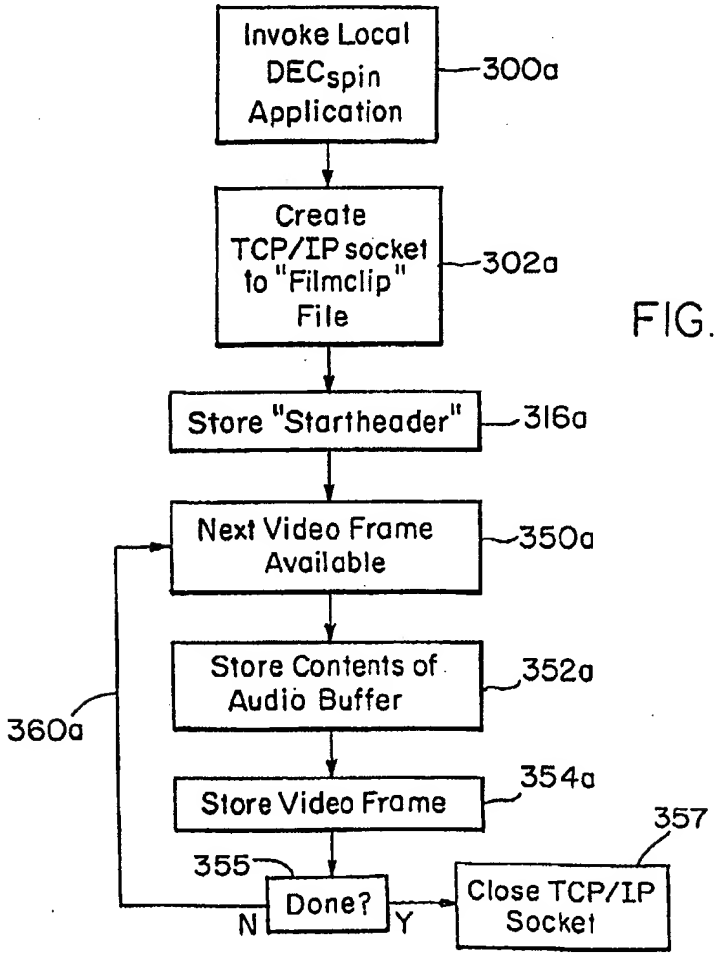
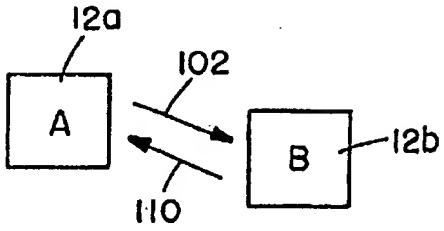
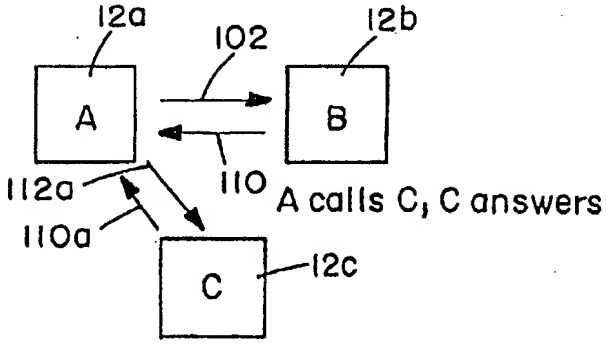


FIG. 14(a)



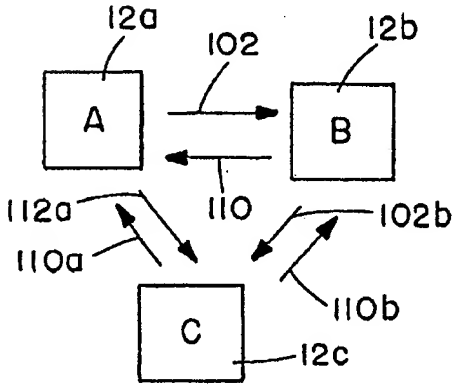
A calls B, B answers

FIG. 5A



A calls C, C answers

FIG. 5B



B calls C or A joins B and C

FIG. 5C

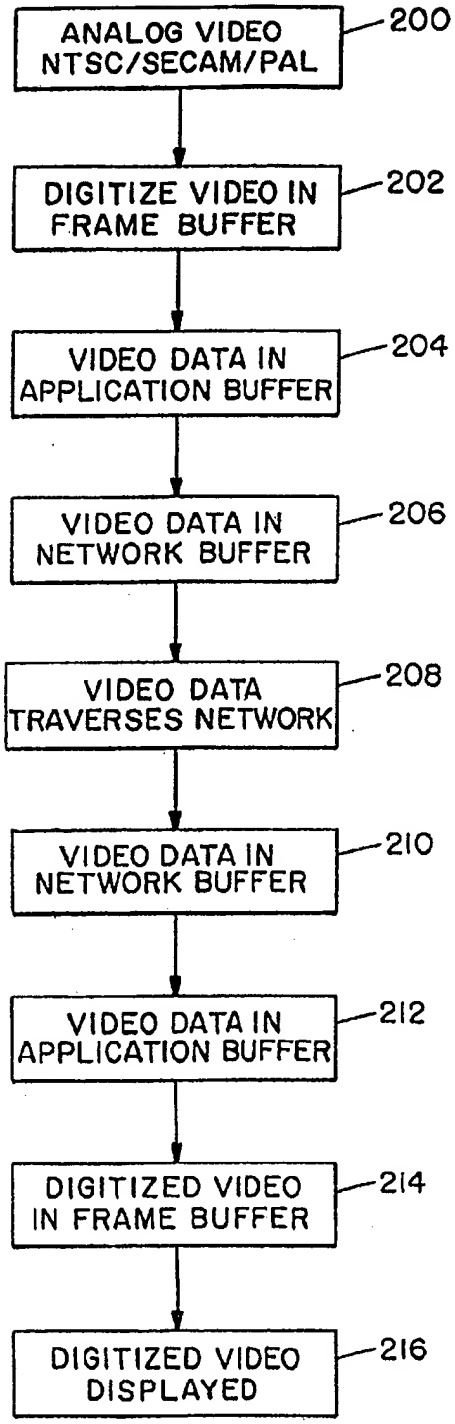

ANALOG VIDEO NTSC/SECAM/PAL
200
DIGITIZE VIDEO IN FRAME BUFFER
202
VIDEO DATA IN APPLICATION BUFFER
204
VIDEO DATA IN NETWORK BUFFER
206
VIDEO DATA TRAVERSES NETWORK
208
VIDEO DATA IN NETWORK BUFFER
210
VIDEO DATA IN APPLICATION BUFFER
212
DIGITIZED VIDEO IN FRAME BUFFER
214
DIGITIZED VIDEO DISPLAYED
216

FIG. 6

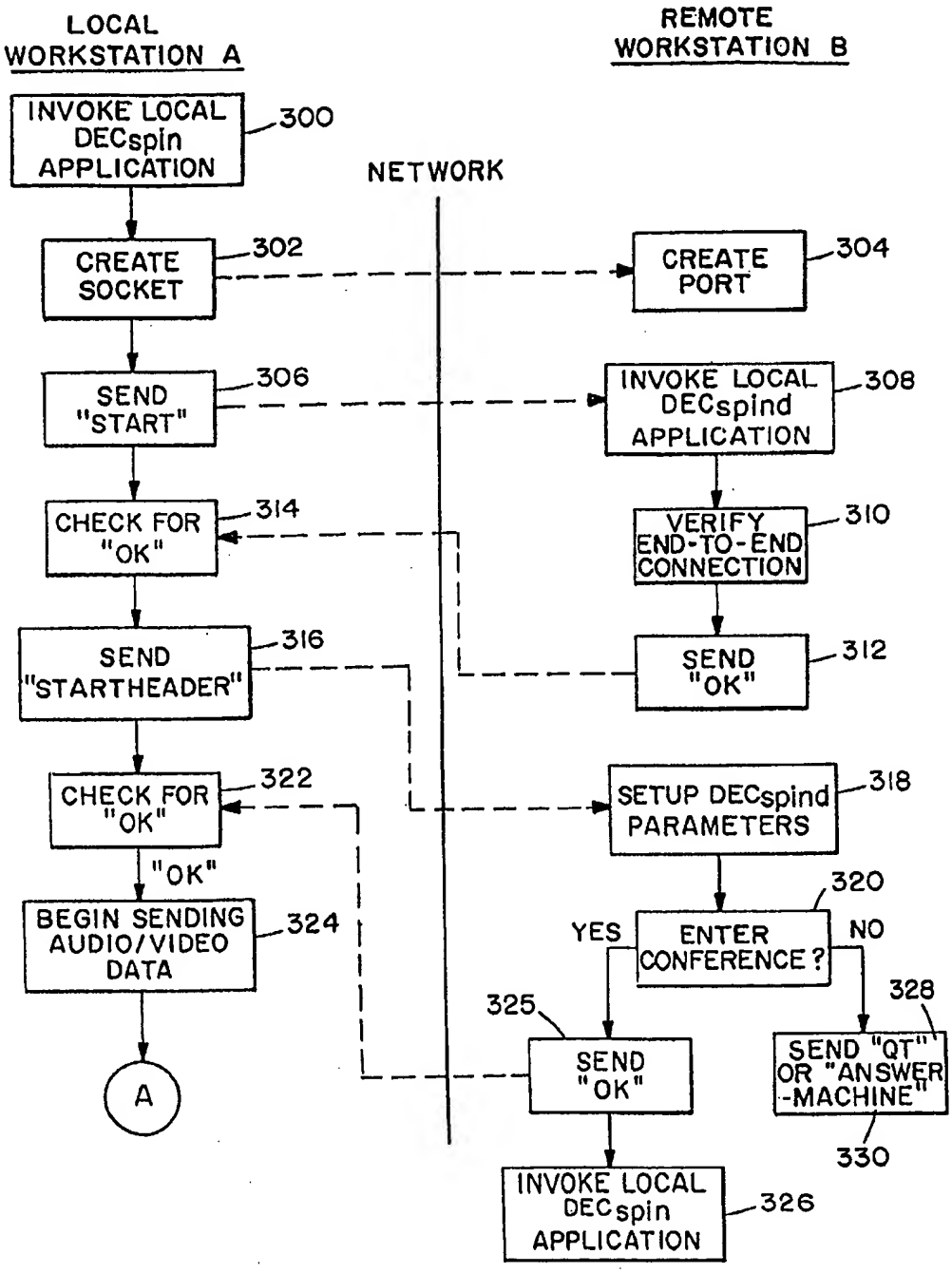

LOCAL WORKSTATION A
REMOTE WORKSTATION B
NETWORK
INVOKE LOCAL DECspin APPLICATION
300
CREATE SOCKET
302
CREATE PORT
304
SEND "START"
306
INVOKE LOCAL DECspind APPLICATION
308
CHECK FOR "OK"
314
VERIFY END-TO-END CONNECTION
310
SEND "STARTHEADER"
316
SEND "OK"
312
CHECK FOR "OK"
322
SETUP DECspind PARAMETERS
318
"OK"
BEGIN SENDING AUDIO/VIDEO DATA
324
320
YES
ENTER CONFERENCE?
NO
325
328
SEND "OK"
SEND "QT" OR "ANSWER -MACHINE"
330
A
INVOKE LOCAL DECspin APPLICATION
326

FIG. 7

START

01010100 = 0x54	01010011 = 0x53

Total length = 2 bytes

FIG. 8

OK

01001011 = 0x4B	01001111 = 0x4F

Total length = 2 bytes

FIG. 9

STARTHEADER

5 reserved longwords (32 bits each)

framerate desired (longword) 406

DTP flags 412

2 reserved longwords

total number of frames 408

1 reserved longword

video width 400

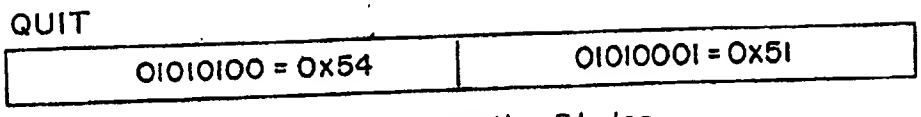
video height 402

bits per pixel (8 or 24) 404

35 reserved longwords

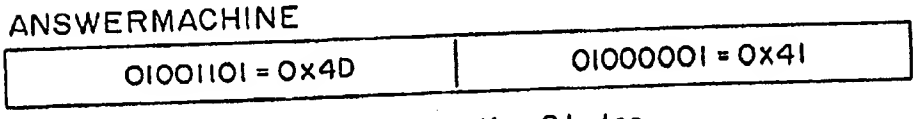
78 longwords (used as login/user handle) 410

FIG. 10



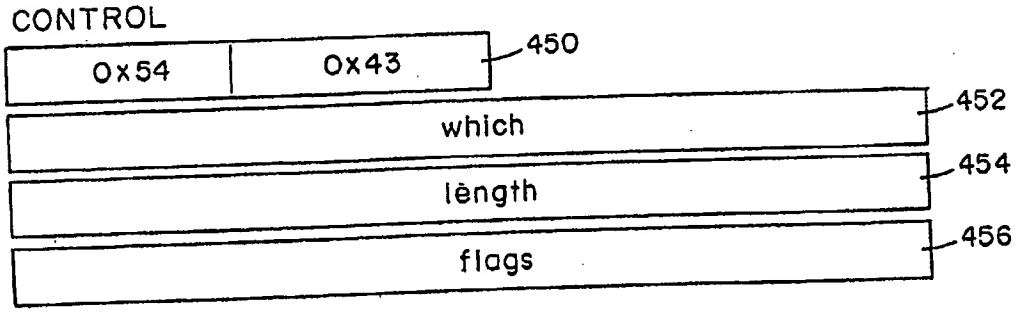
Total length = 2 bytes

FIG. 11



Total length = 2 bytes

FIG. 12



5 reserved longwords

Total length is 34 bytes

FIG. 13

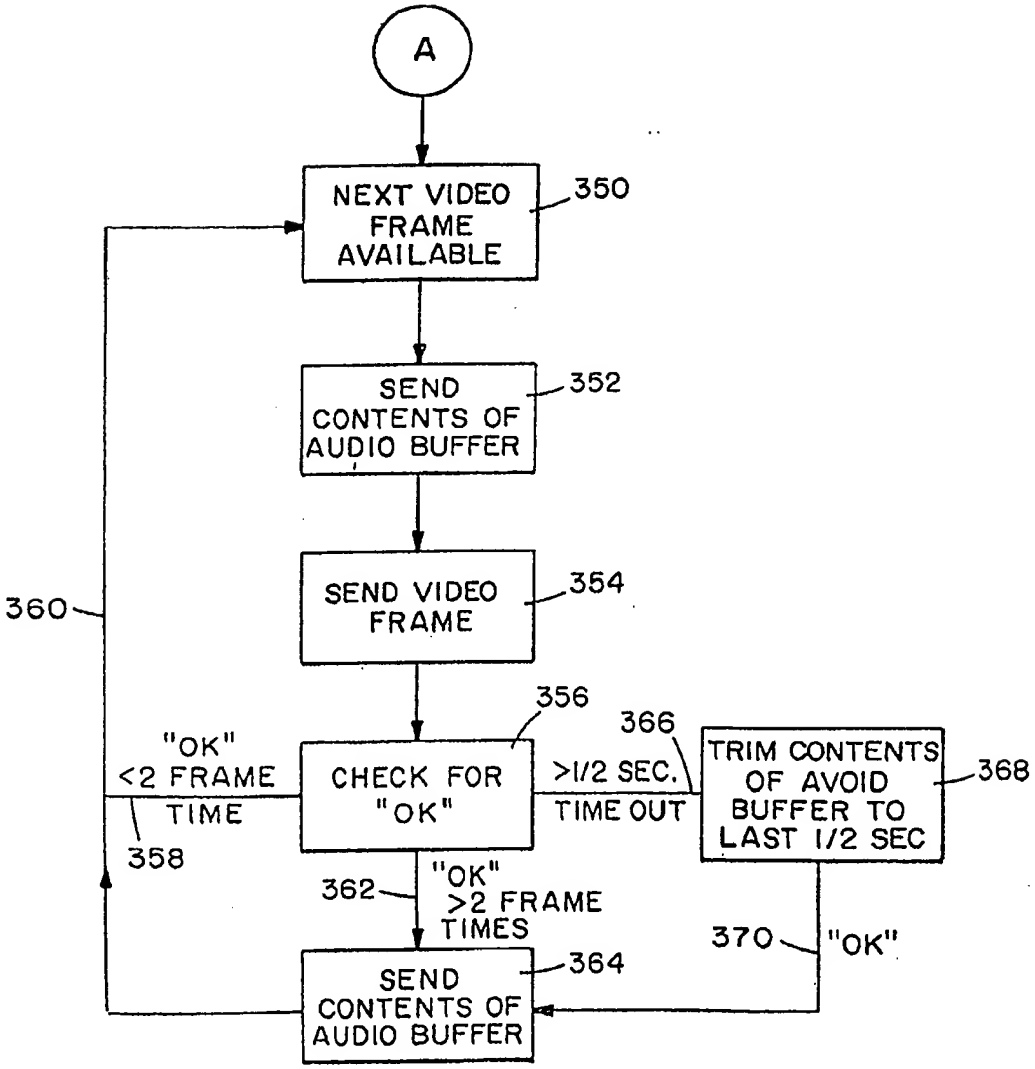

A
NEXT VIDEO FRAME AVAILABLE
350
SEND CONTENTS OF AUDIO BUFFER
352
SEND VIDEO FRAME
354
360
356
366
"OK" <2 FRAME TIME
CHECK FOR "OK"
>1/2 SEC. TIME OUT
TRIM CONTENTS OF AVOID BUFFER TO LAST 1/2 SEC
368
358
362
"OK" >2 FRAME TIMES
370
"OK"
SEND CONTENTS OF AUDIO BUFFER
364

FIG. 14

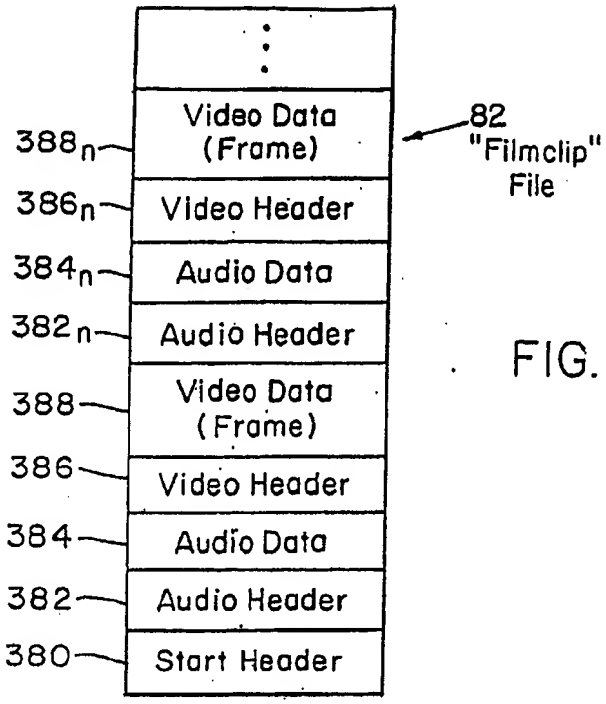


FIG. 14(b)

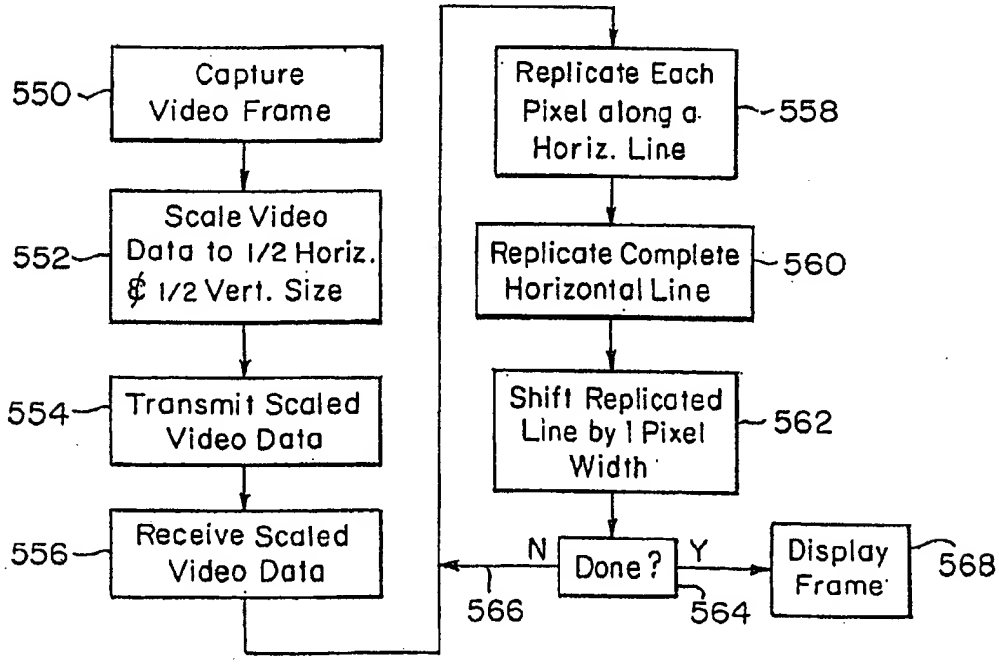


FIG. 27

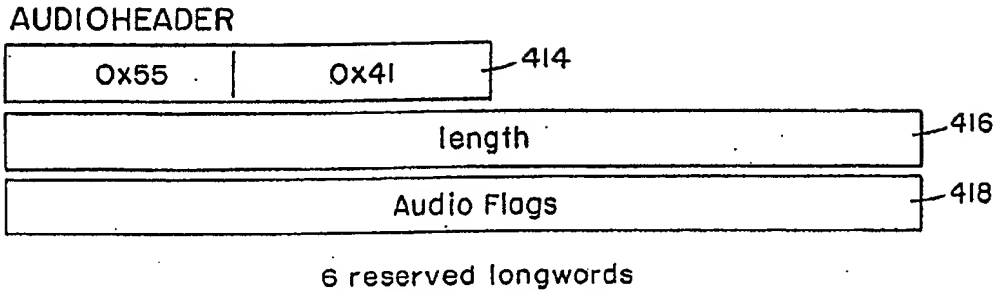

AUDIOHEADER
0x55
0x41
414
length
416
Audio Flags
418
6 reserved longwords

FIG. 15

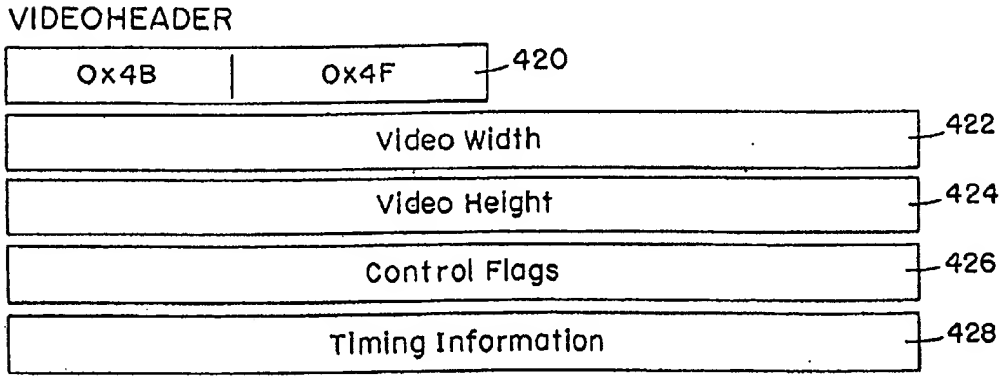

VIDEOHEADER
0x4B
0x4F
420
Video Width
422
Video Height
424
Control Flags
426
Timing Information
428
4 reserved longwords
Total Length is 34 bytes

FIG. 16

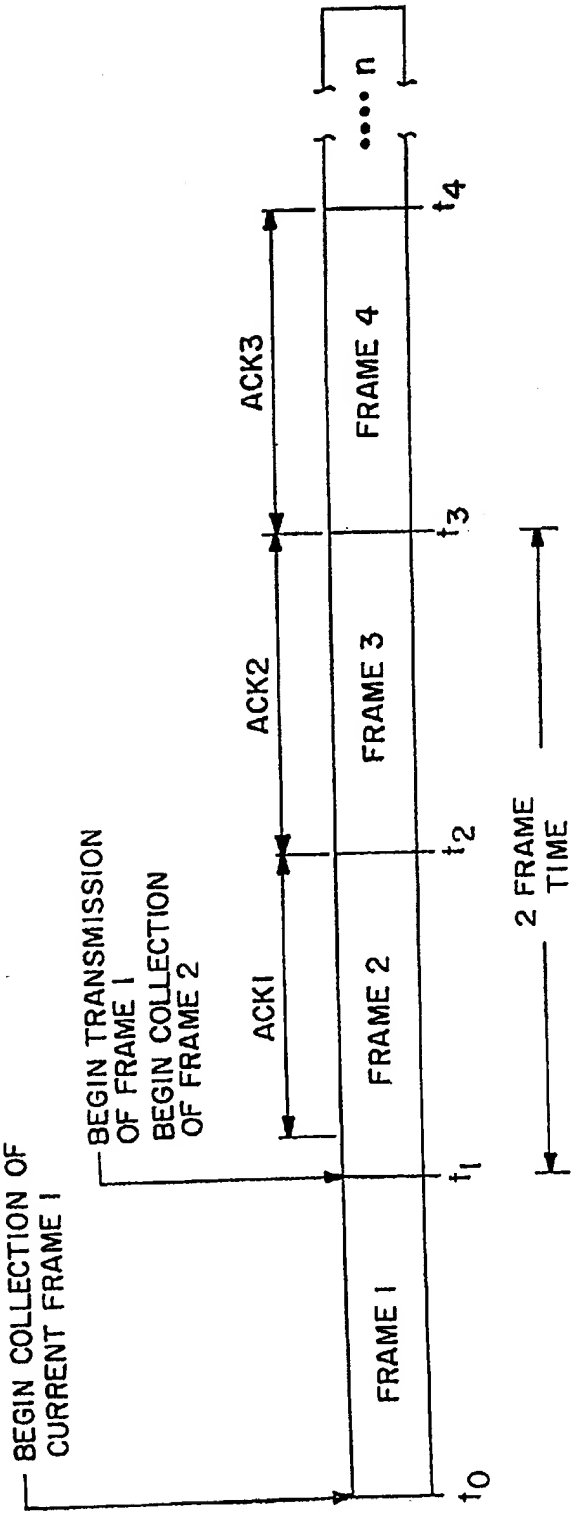

BEGIN COLLECTION OF CURRENT FRAME 1
BEGIN TRANSMISSION OF FRAME 1
BEGIN COLLECTION OF FRAME 2
ACK1
ACK2
ACK3
FRAME 1
FRAME 2
FRAME 3
FRAME 4
• • • • n
t_0
t_1
t_2
t_3
t_4
2 FRAME TIME

FIG. 17

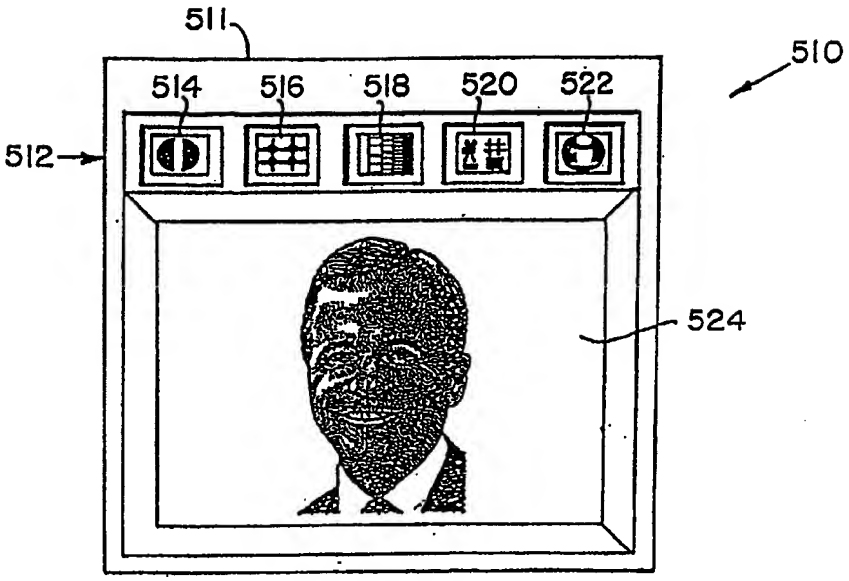


FIG. 18

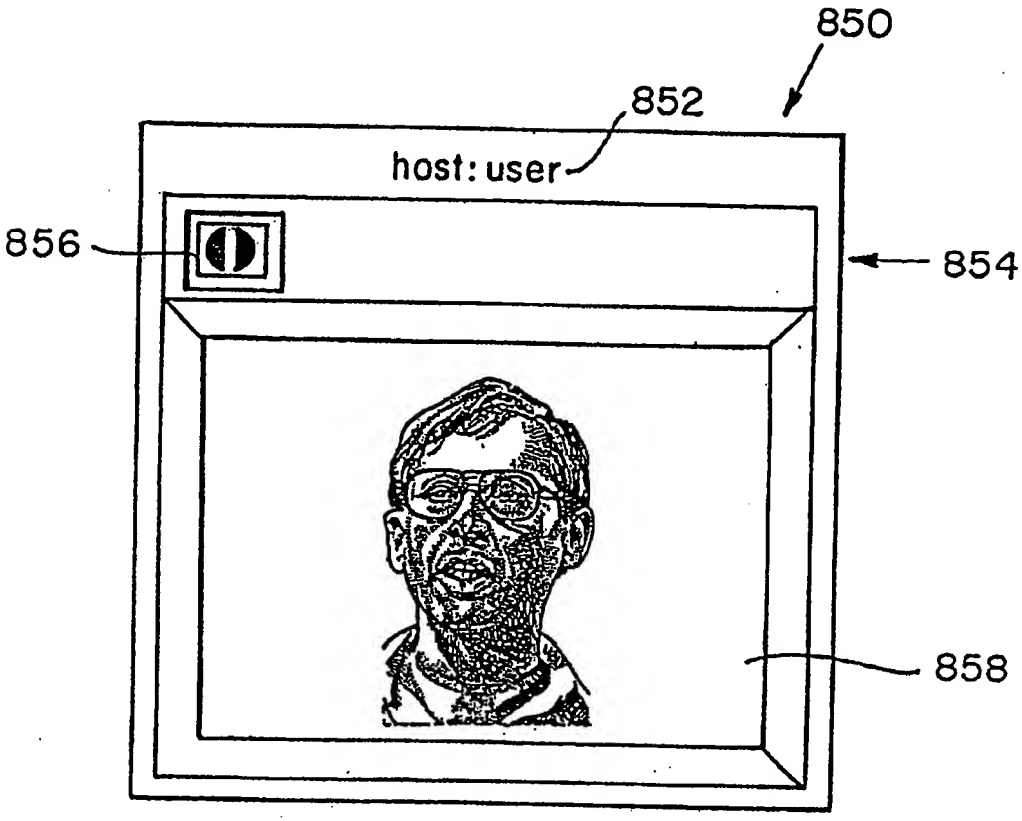


FIG. 19

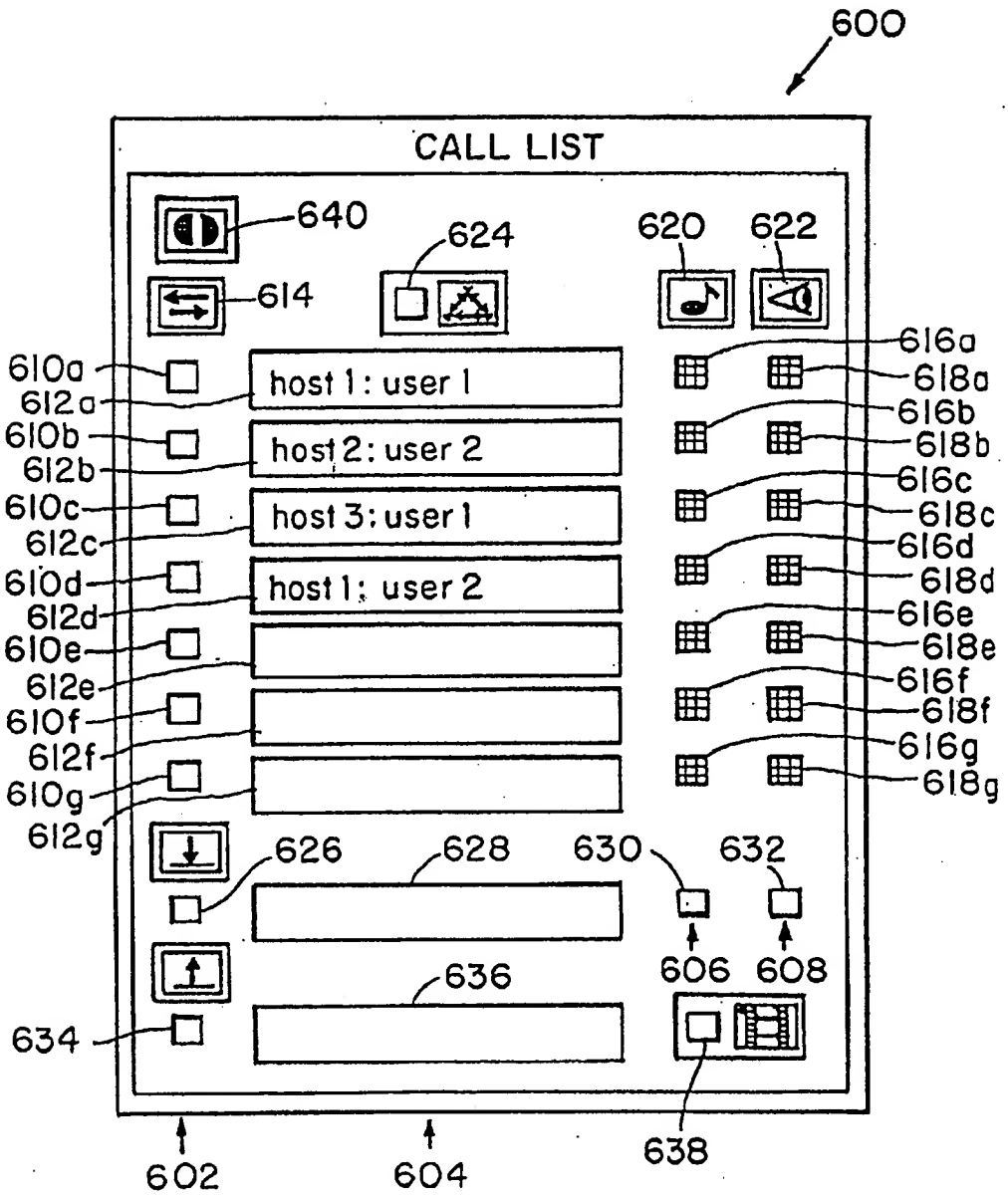

600
CALL LIST
640
624
620
622
614
610a
612a
host 1 : user 1
610b
612b
host 2 : user 2
610c
612c
host 3 : user 1
610d
612d
host 1 ; user 2
610e
612e
610f
612f
610g
612g
616a
618a
616b
618b
616c
618c
616d
618d
616e
618e
616f
618f
616g
618g
626
628
630
632
606
608
636
634
638
602
604

FIG. 20

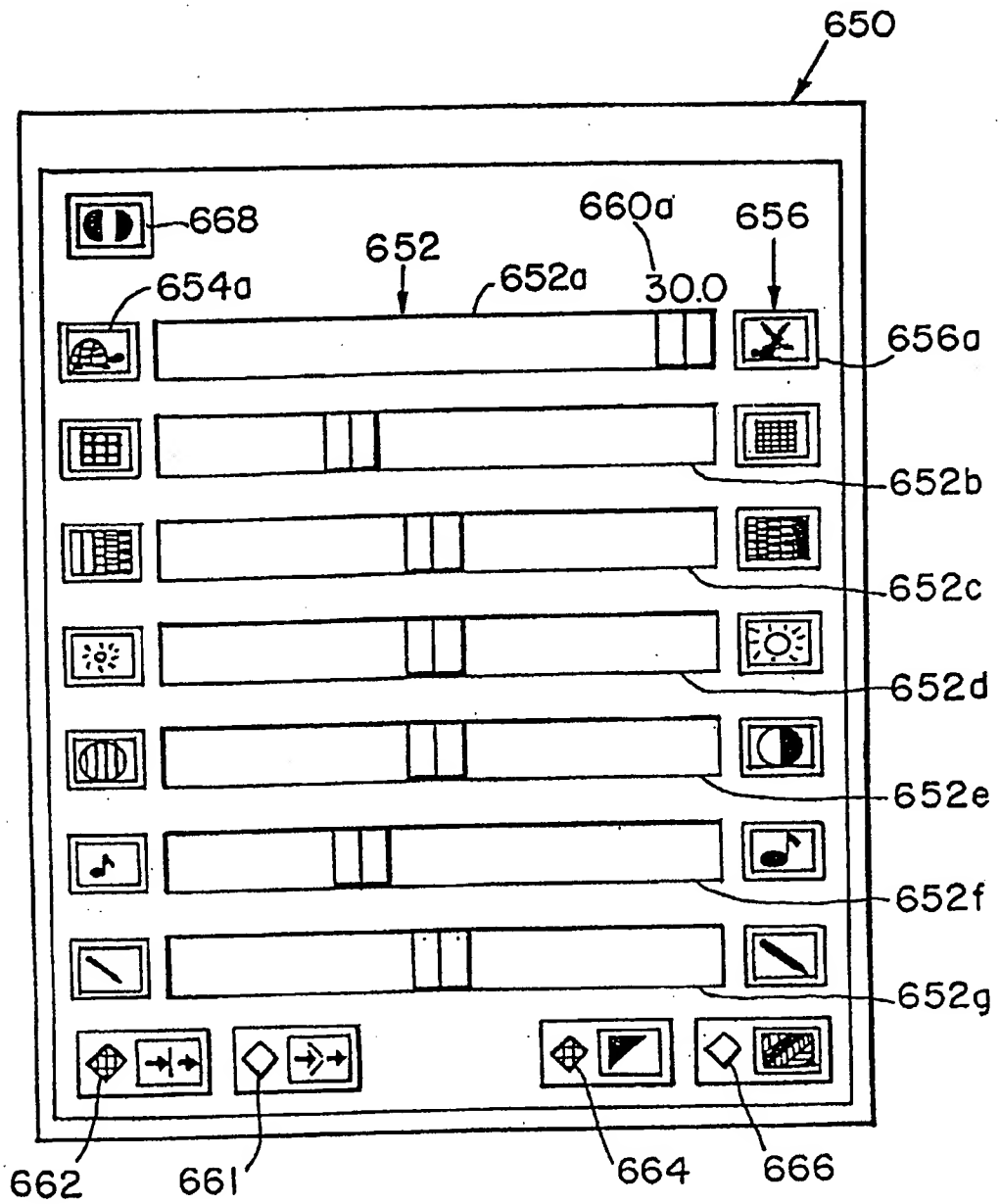

650
668
660a
656
652
652a
30.0
654a
656a
652b
652c
652d
652e
652f
652g
662
661
664
666

FIG. 21

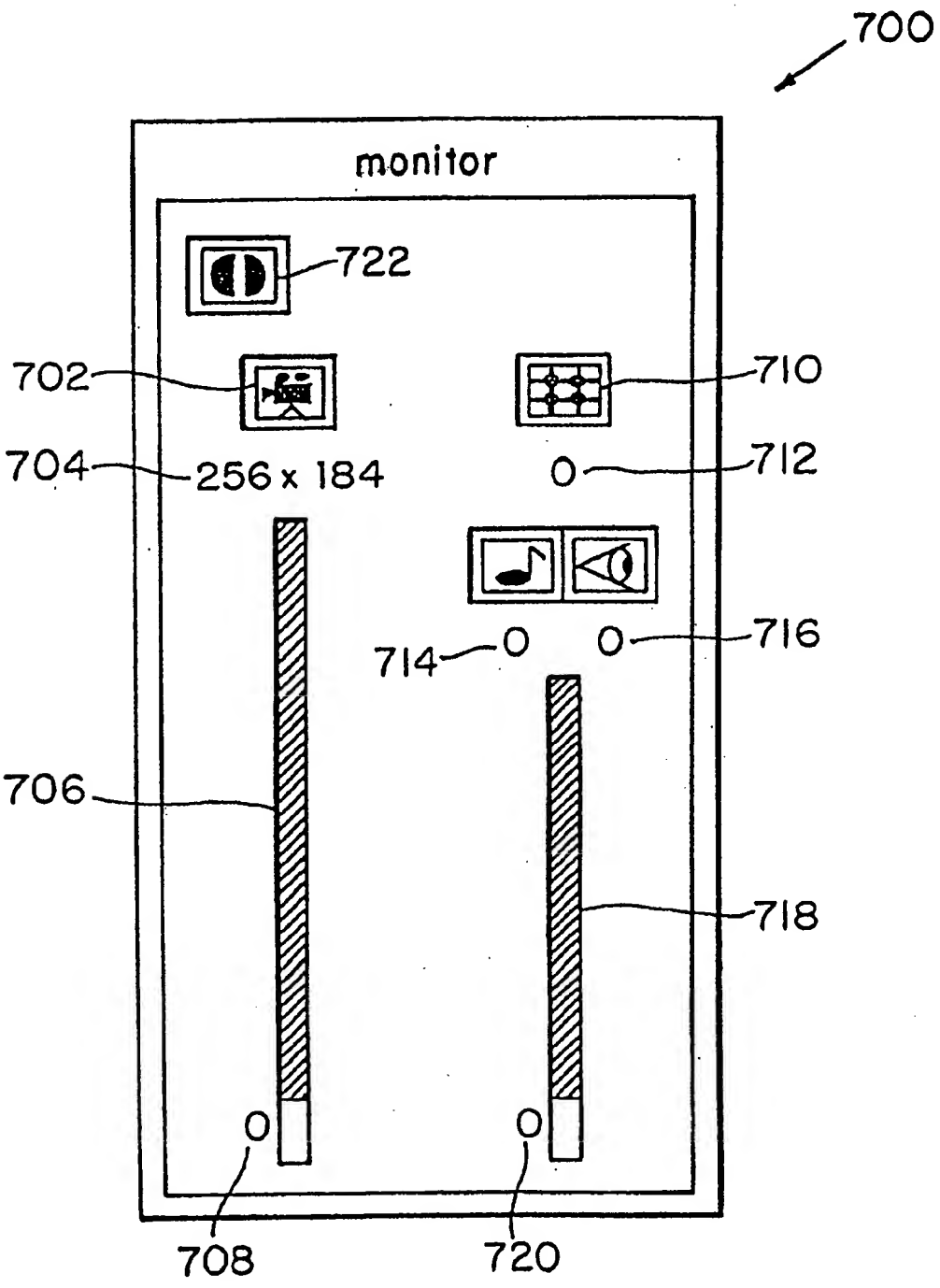

700
monitor
722
702
710
704
256 x 184
0
712
714
0
0
716
706
718
0
0
708
720

FIG. 22

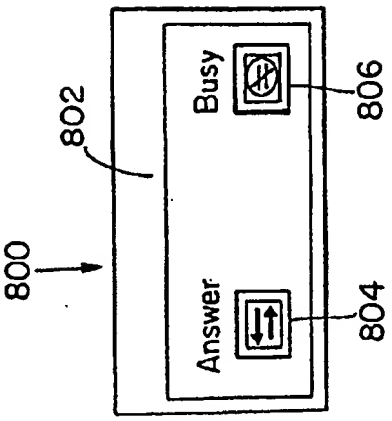


FIG. 25

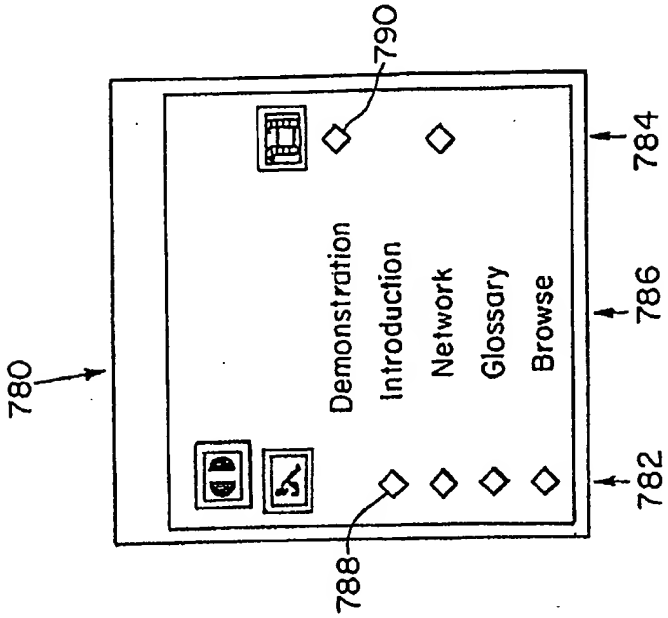


FIG. 24

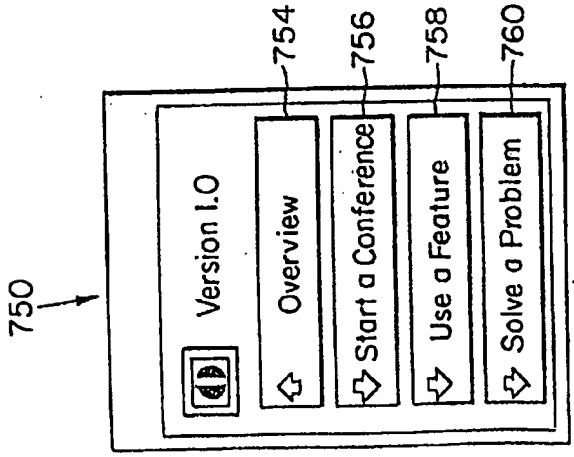


FIG. 23

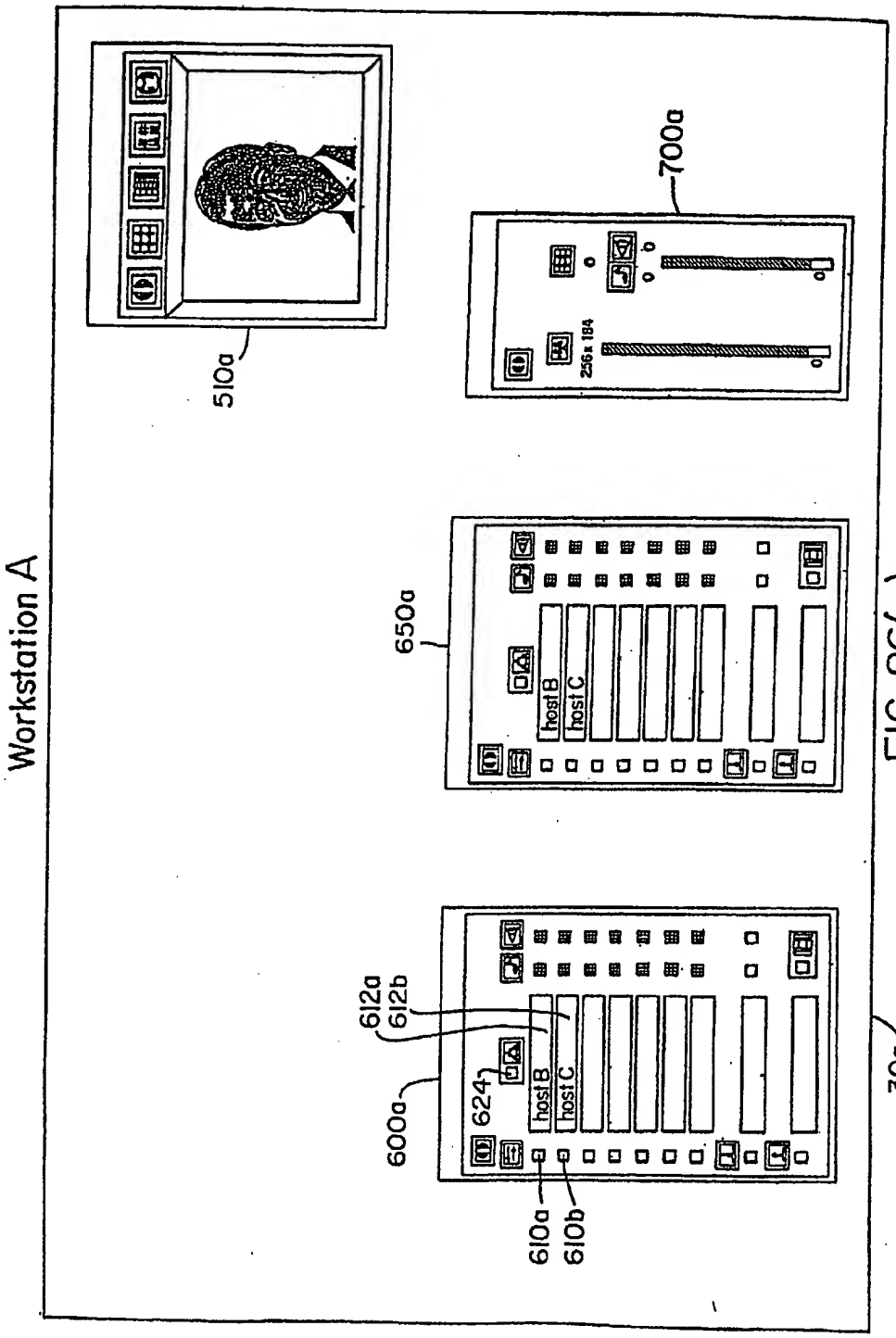

Workstation A
510a
700a
256 x 184
650a
host B
host C
612a
612b
624
600a
610a
610b
30a

FIG. 26(a)

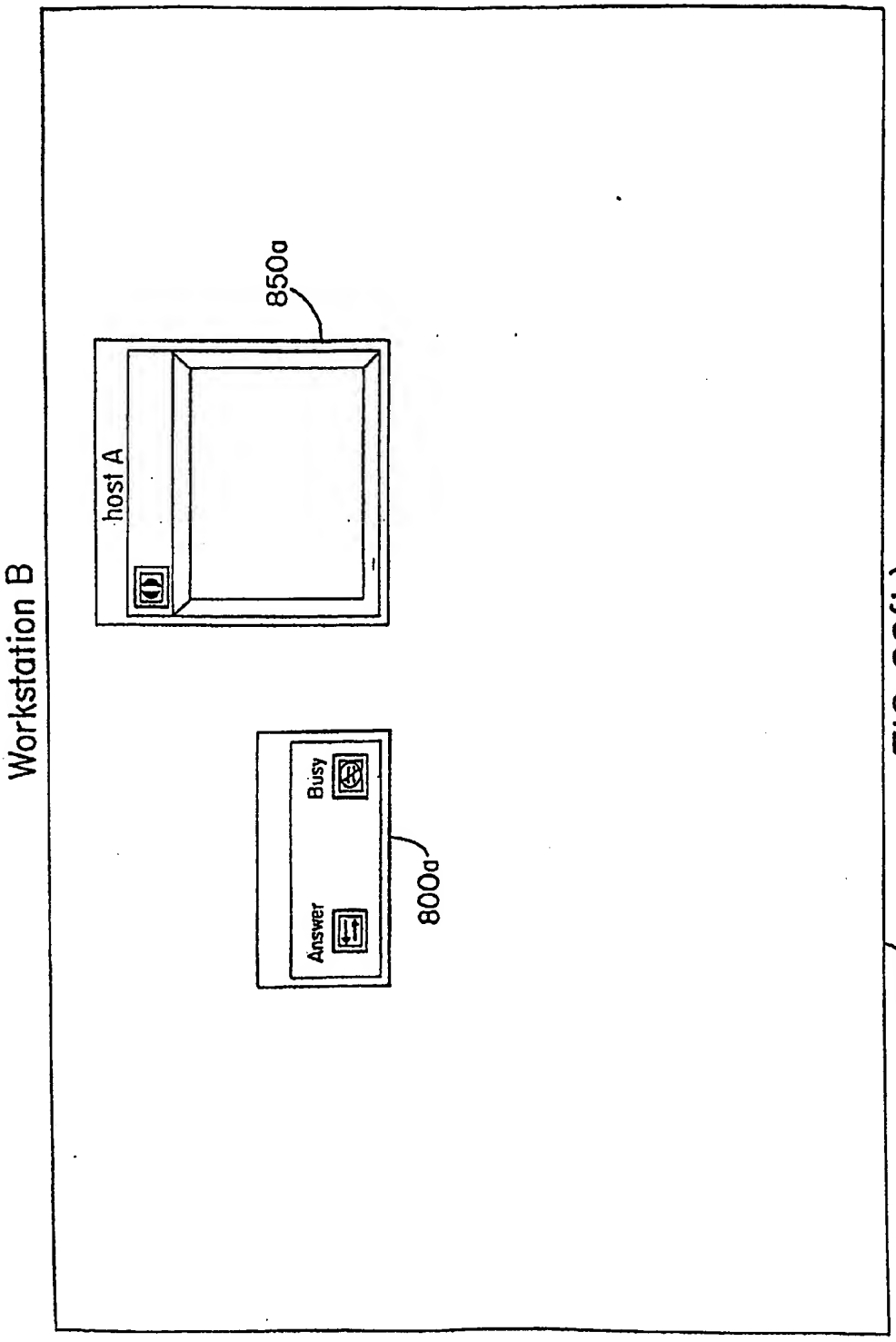


FIG. 26(b)

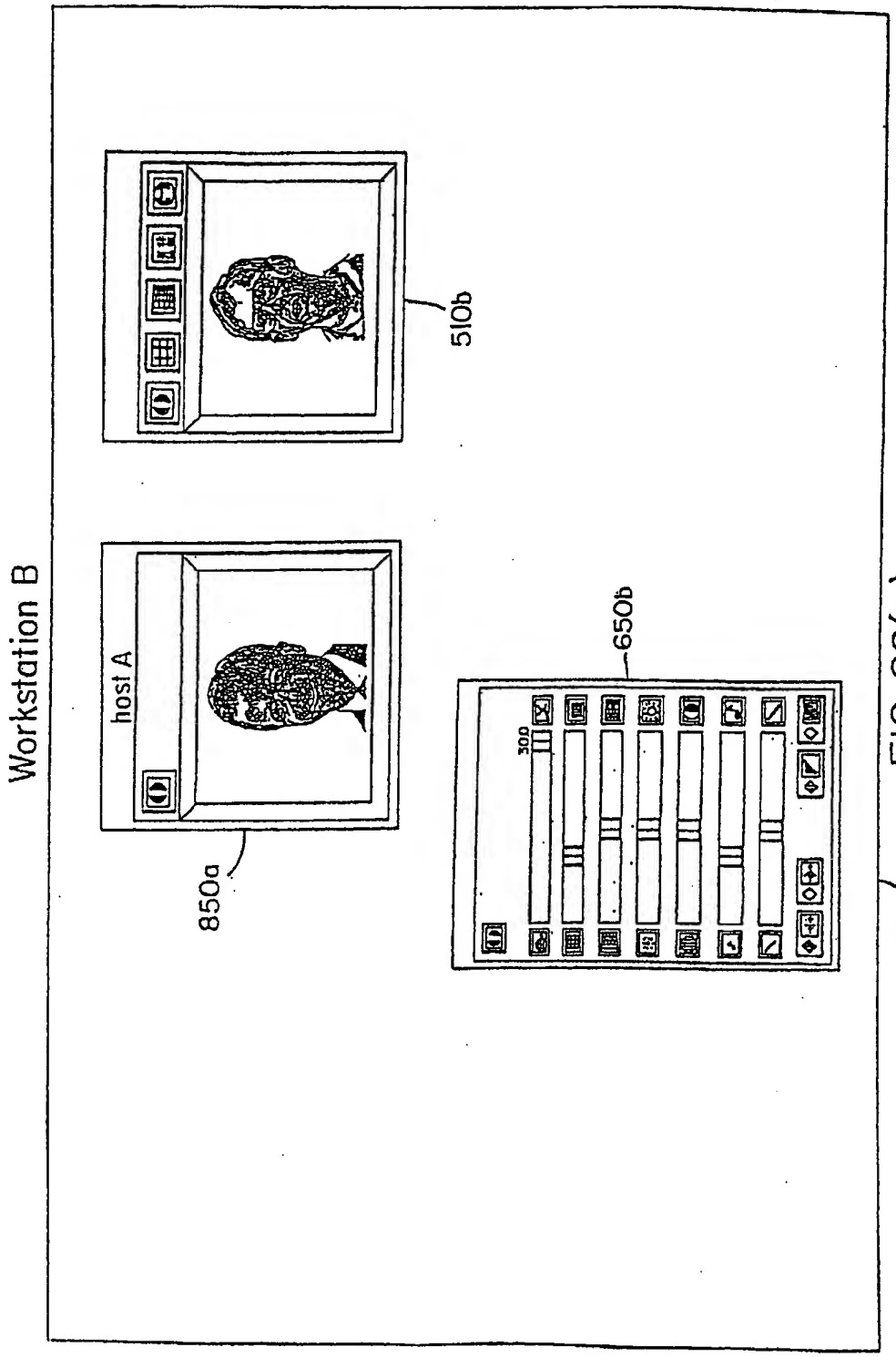


FIG. 26(c)

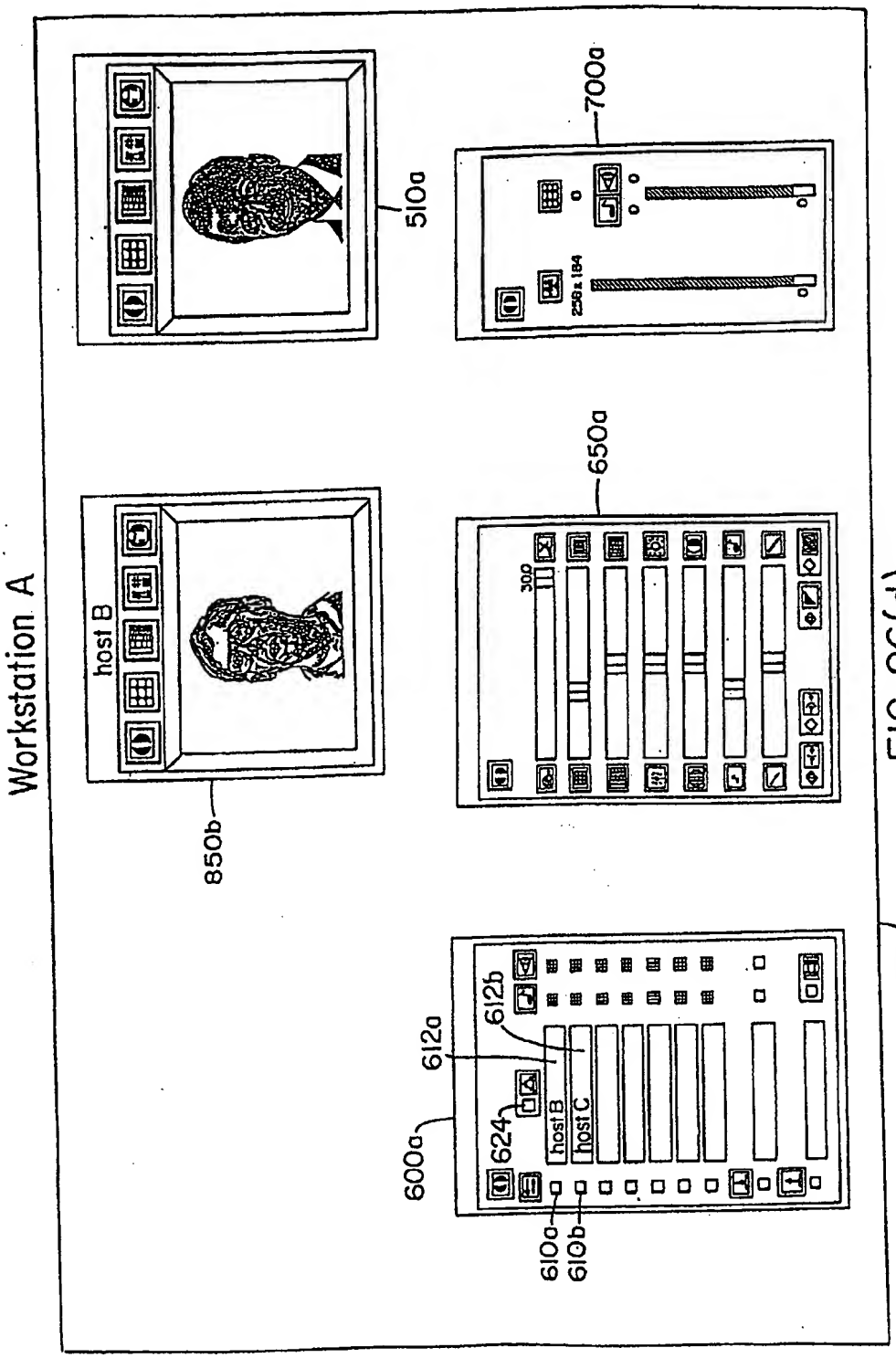

Workstation A
host B
510a
700a
650a
850b
300
612b
612a
624
host B
host C
600a
610a
610b
30a

FIG. 26(d)

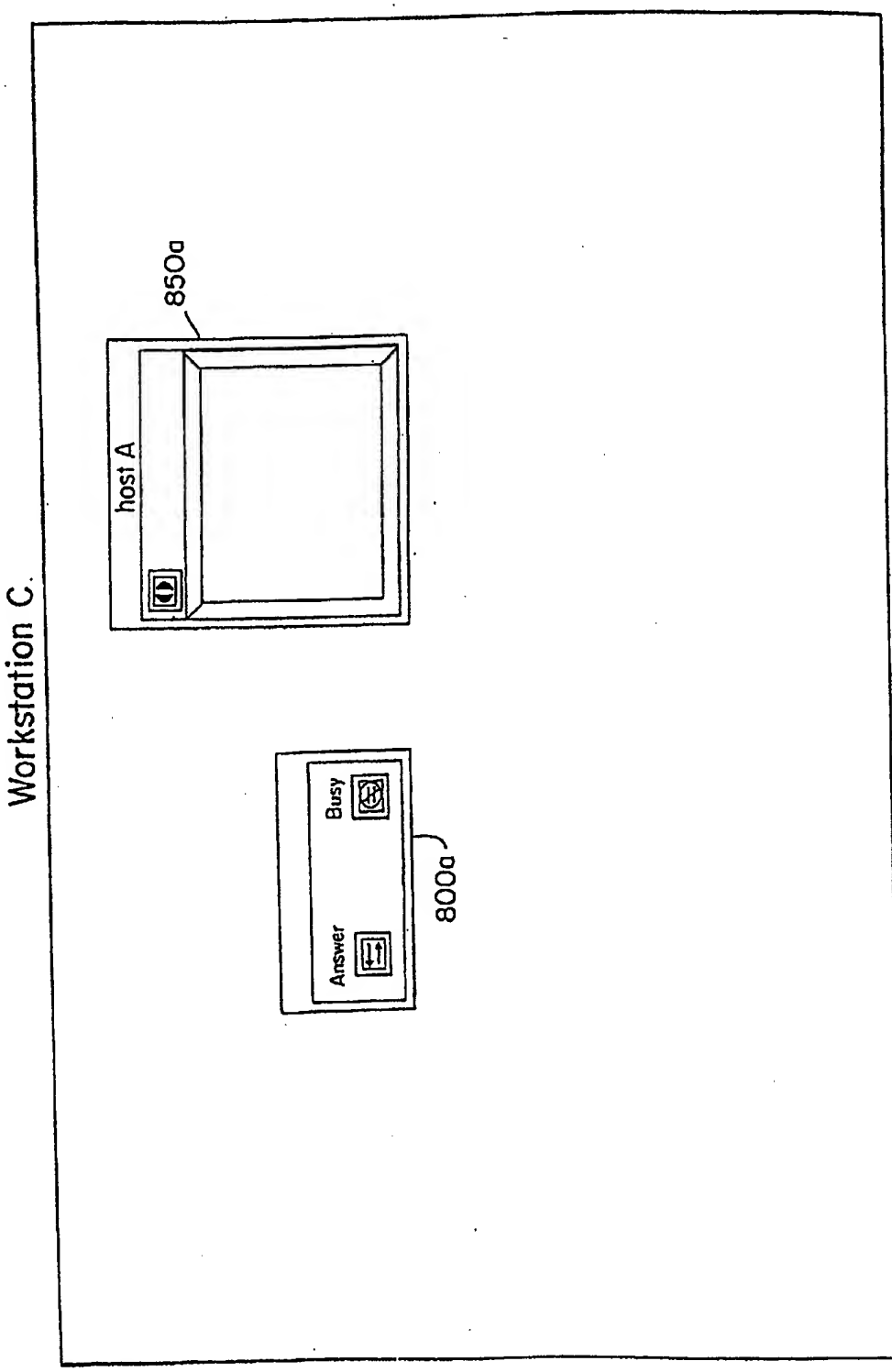


FIG. 26(e)

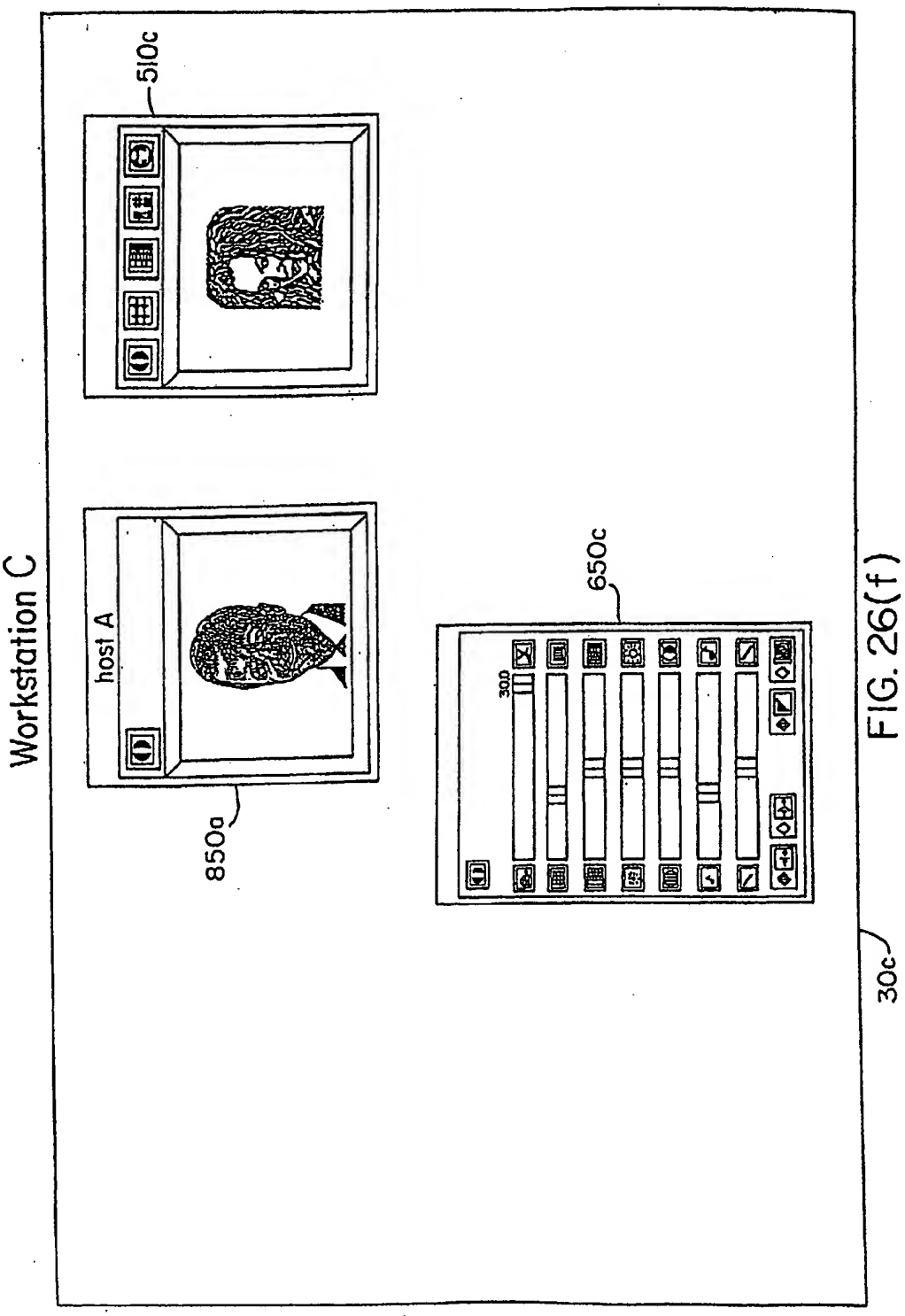


FIG. 26(f)

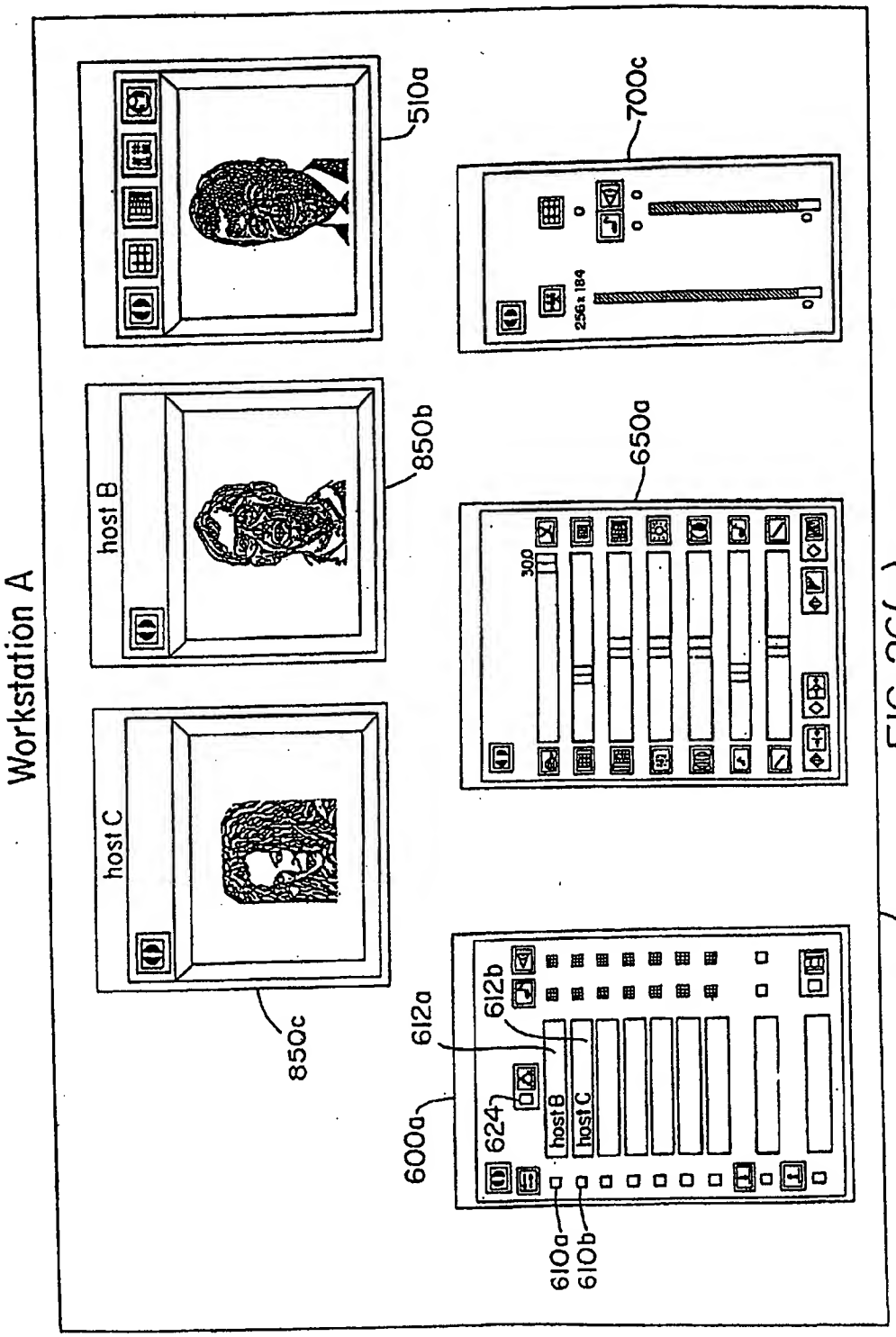

Workstation A
host B
host C
510a
850b
850c
700c
650a
300
612b
612a
624
host B
host C
600a
610a
610b
30a

FIG. 26(g)

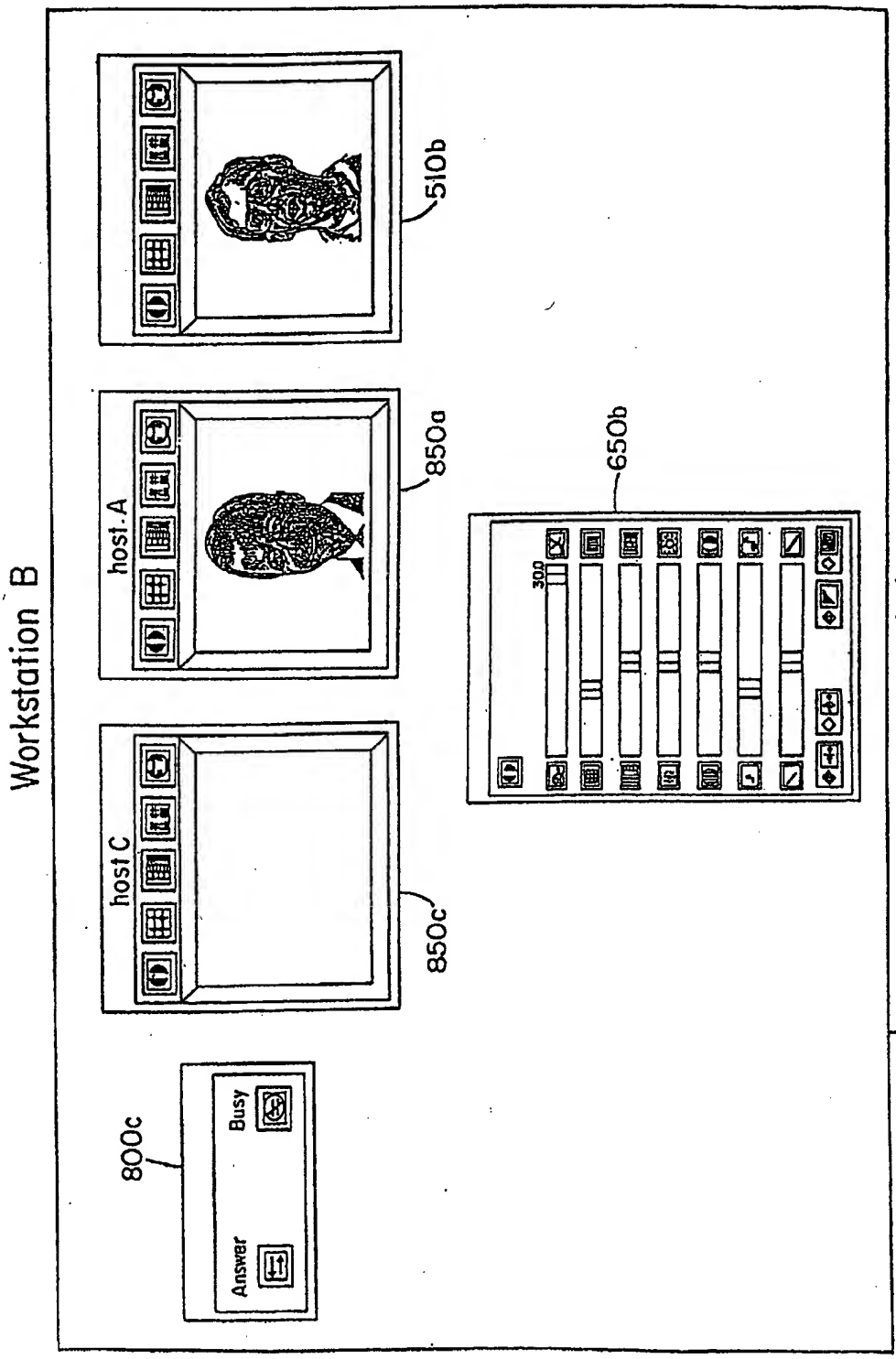

Workstation B
host C
host A
Busy
Answer
800c
850c
850a
510b
650b
300
30b

FIG. 26(h)

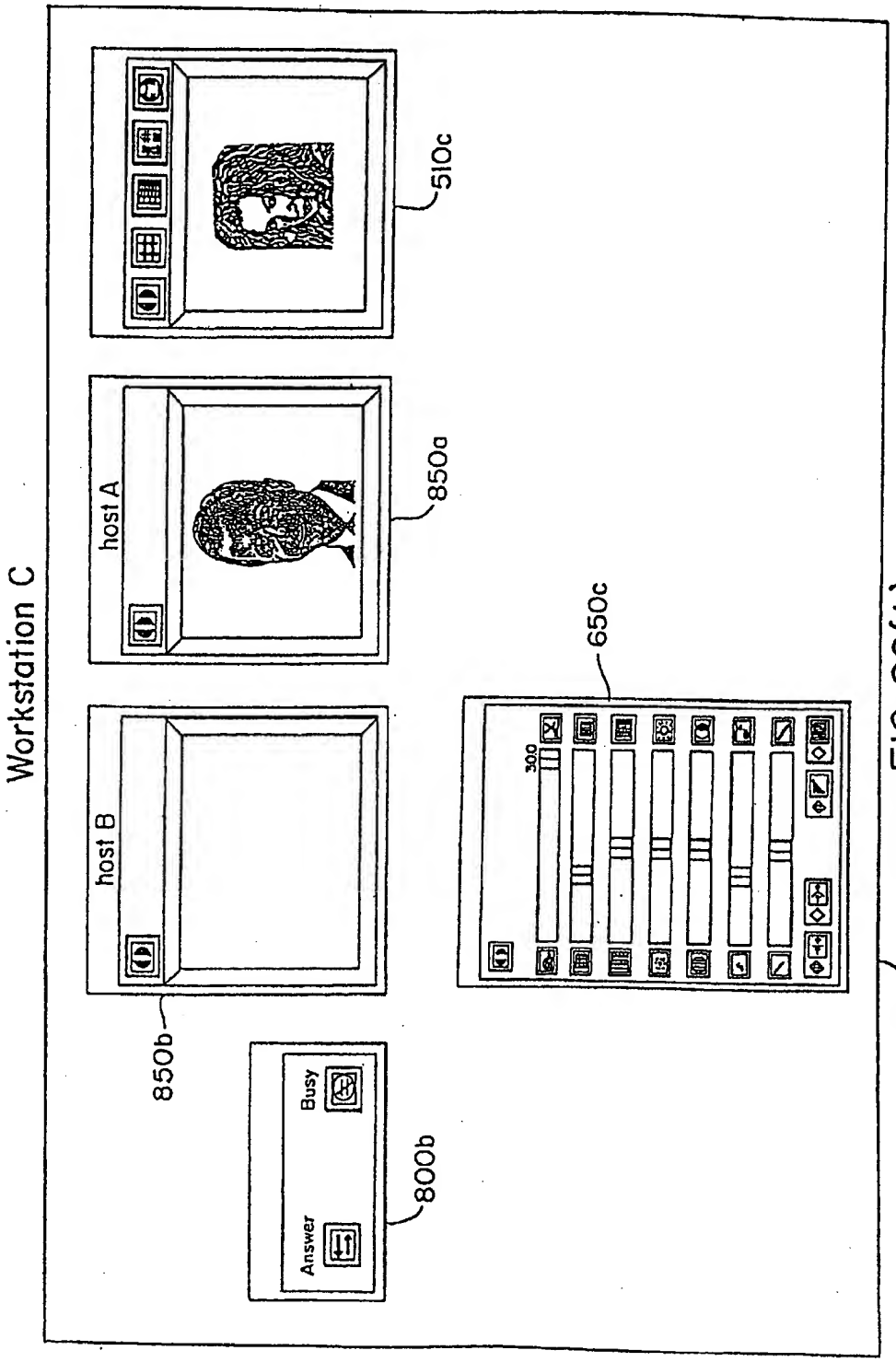

Workstation C
host A
host B
Busy
Answer
510c
850a
850b
800b
650c
300
30c

FIG. 26(i)

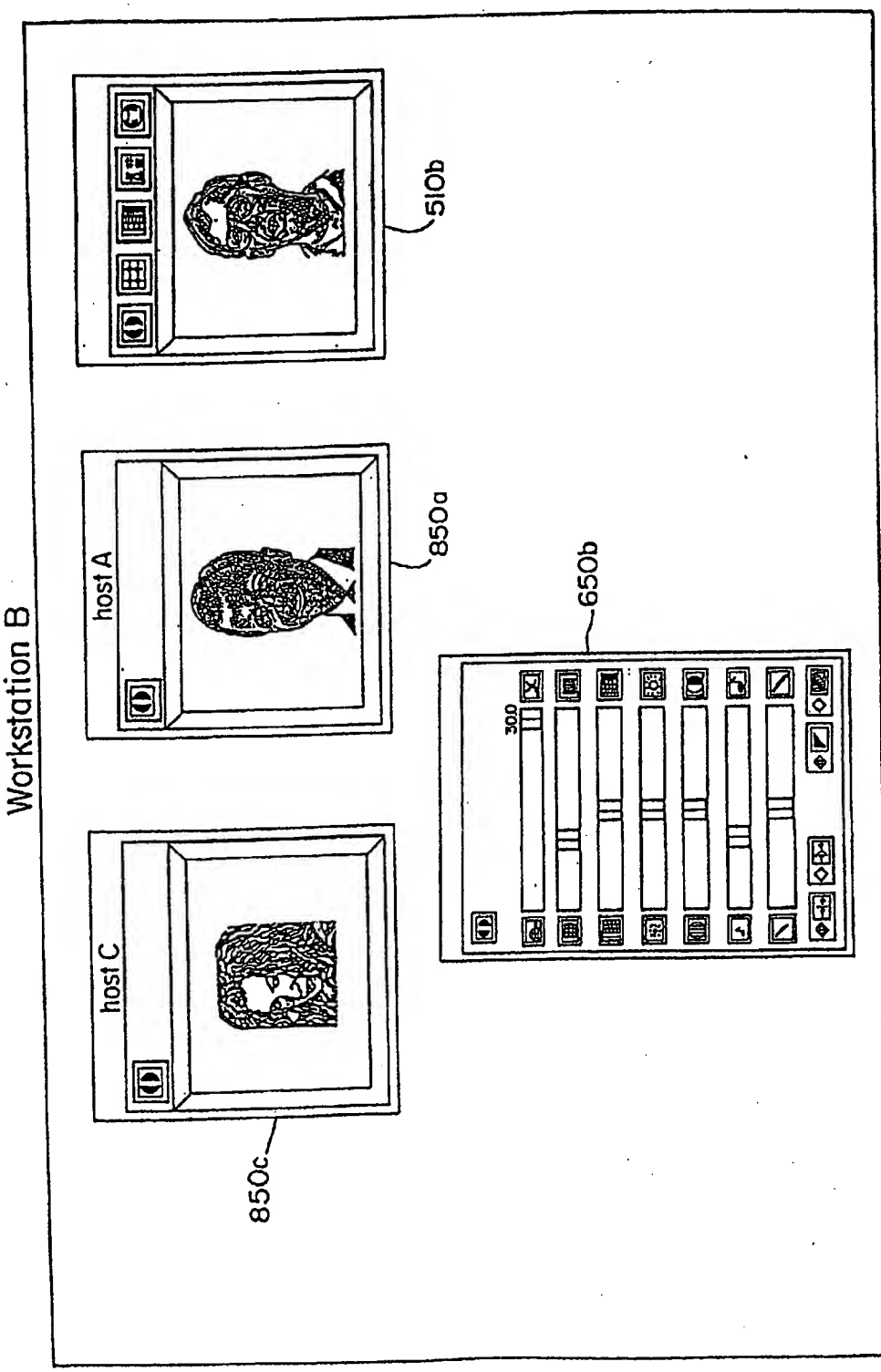


FIG. 26(j)

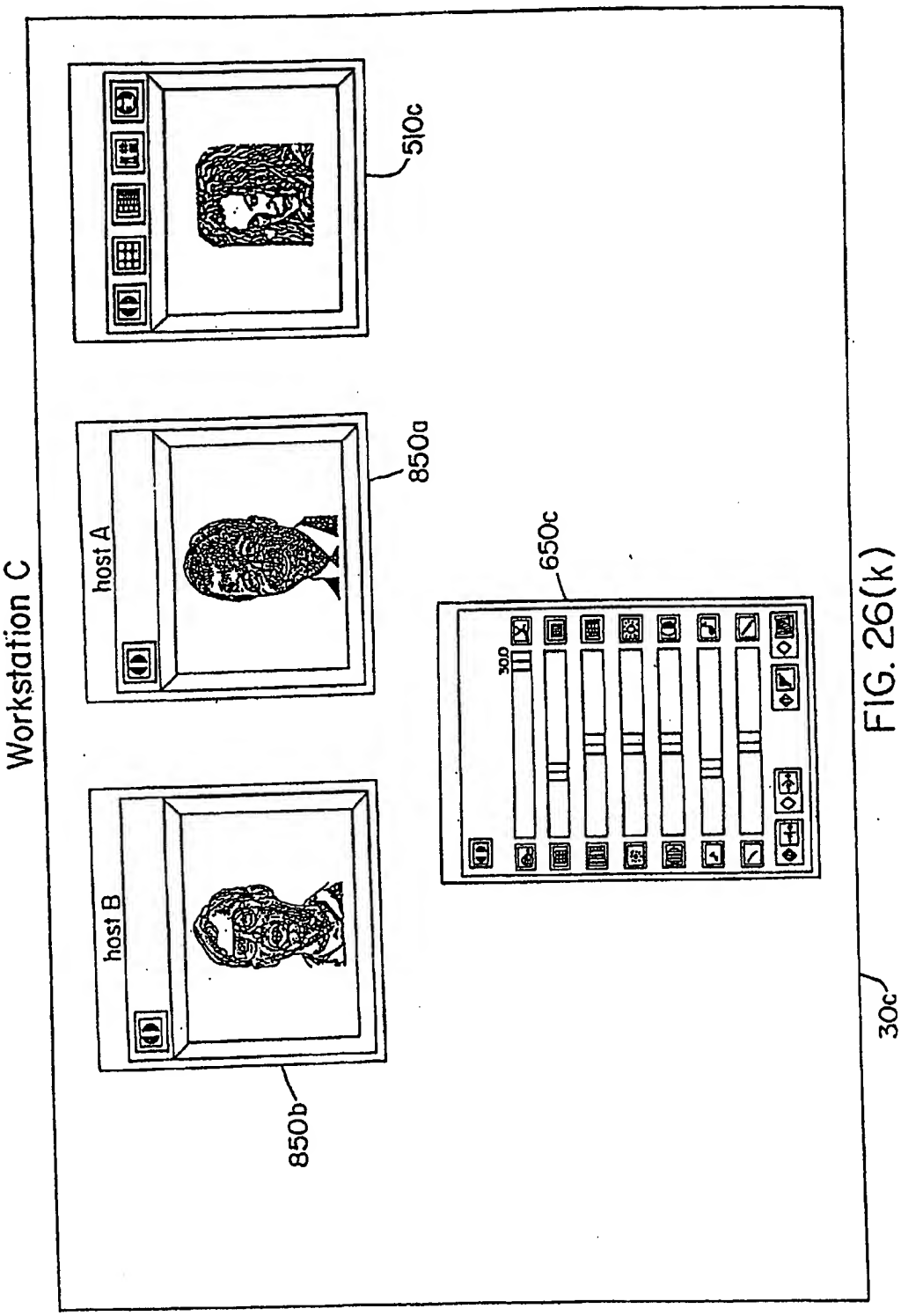


FIG. 26(k)

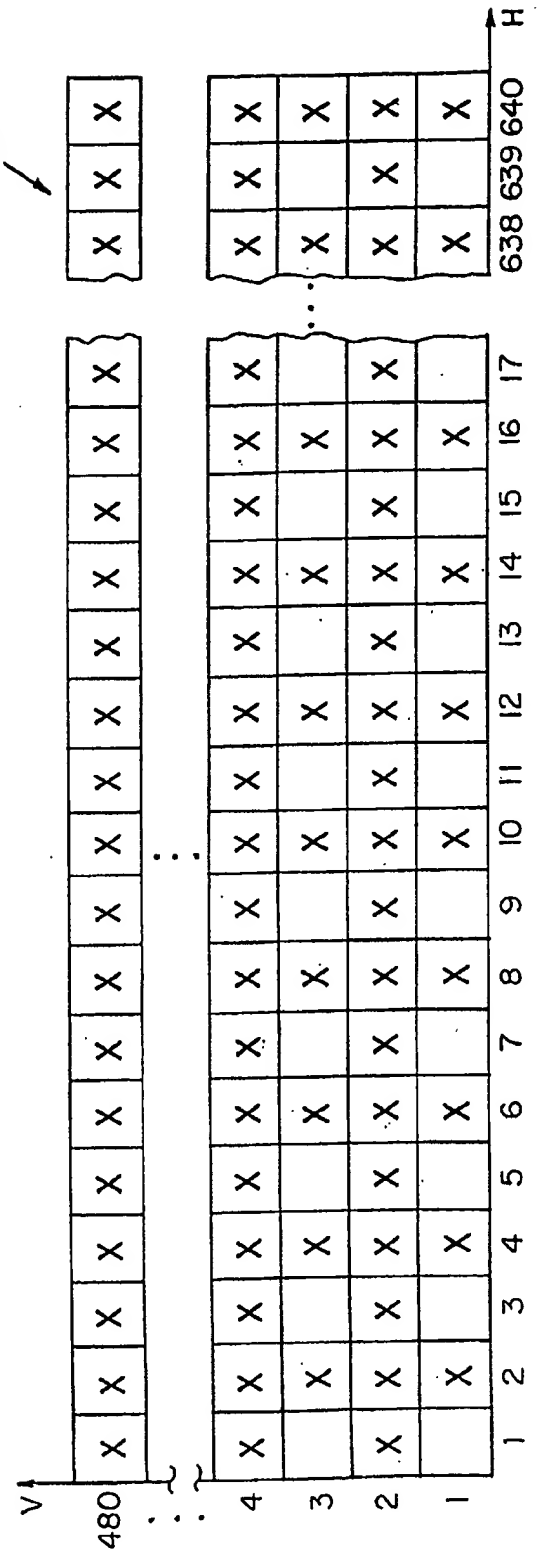


FIG. 28(a)

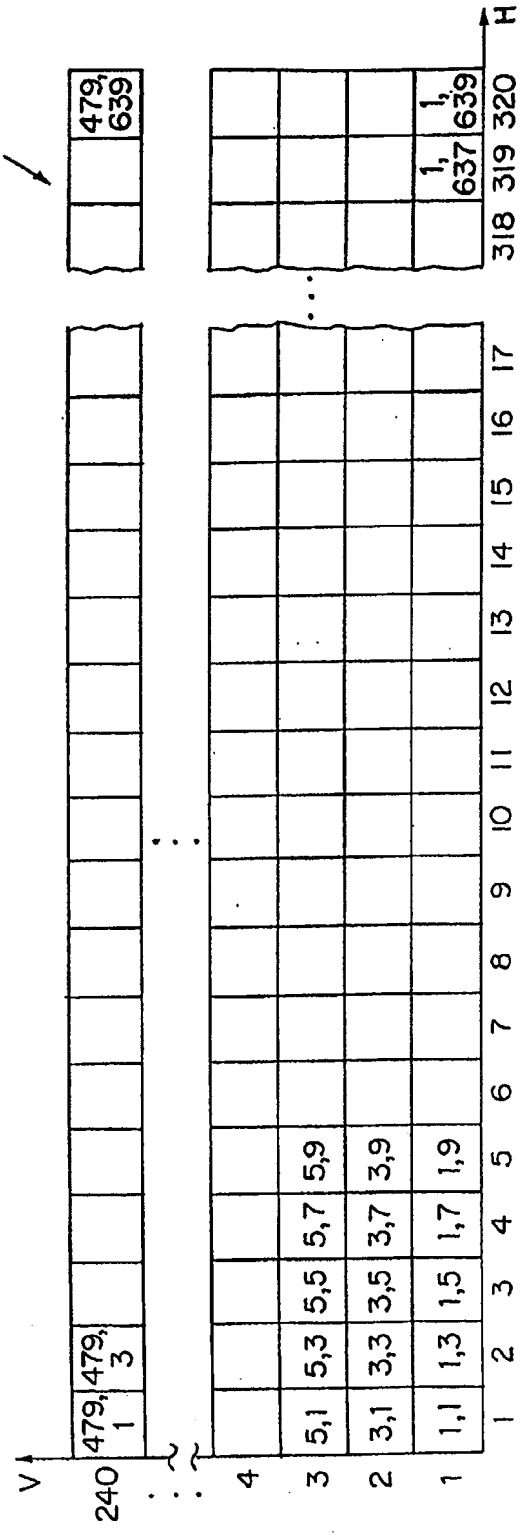

582
V
H
240
4
3
2
1
479, 1
479, 3
479, 639
1, 637
1, 639
1,1
1,3
1,5
1,7
1,9
3,1
3,3
3,5
3,7
3,9
5,1
5,3
5,5
5,7
5,9
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
318 319 320

FIG. 28(b)

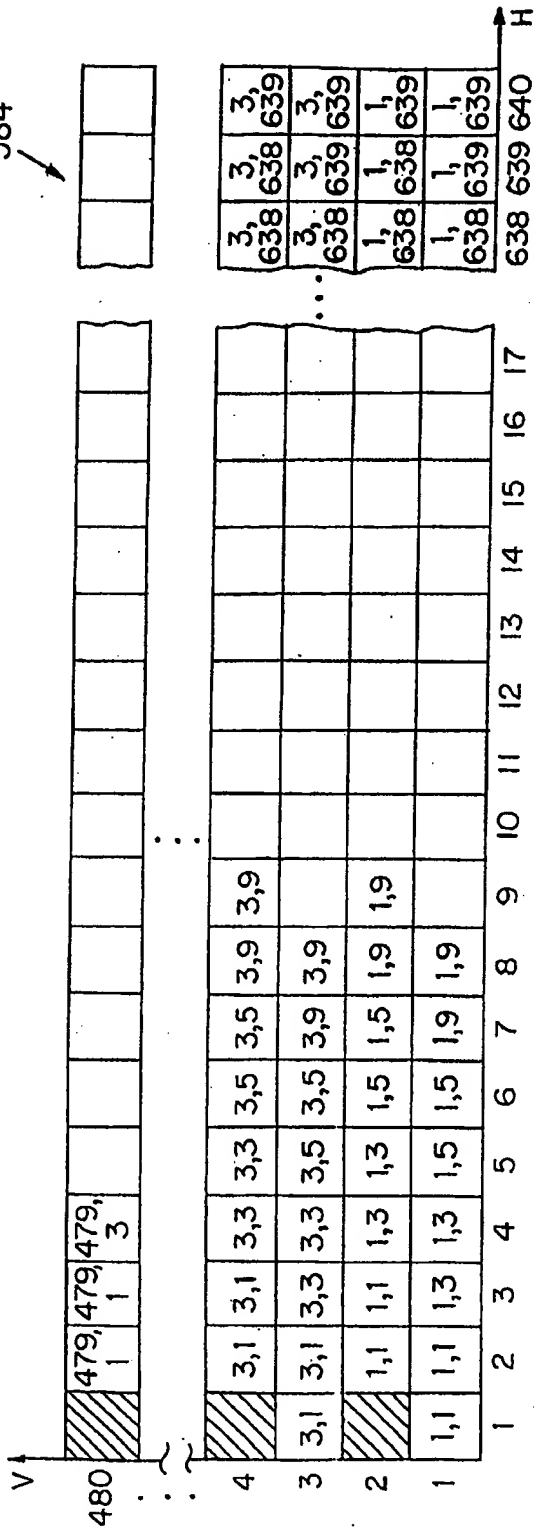


FIG. 28(c)

AUDIO/VIDEO STORAGE AND RETRIEVAL FOR MULTIMEDIA WORKSTATIONS

RELATED APPLICATIONS

This application is a continuation of application Ser. No. 07/915,088 filed Jul. 16, 1992 now U.S. Pat. No. 5,623,690 which is a Continuation-in-Part of U.S. Ser. No. 07/893,074, filed Jun. 3, 1992 and U.S. Ser. No. 07/893,234, filed Jun. 3, 1992.

BACKGROUND OF THE INVENTION

Video communications has evolved over the years from a simple video telephone concept to a sophisticated network for allowing multiple users to participate in a video teleconference. For full featured video teleconferencing, users require both an audio communications path and a real time visual communication path synchronized to the audio path. Furthermore, it is desirable to support full color video and telephone quality audio. Video teleconferencing capabilities are limited mainly by the bandwidth of the transmission medium connecting the teleconferencing terminals.

Many computer workstations used in the office or laboratory environment today are connected with other workstations, file servers, or other resources over high-speed local area networks. Local area networks, in turn are often connected together through high-speed gateways which connect workstations which may be distributed over a wide geographic area. Network wide protocols allow workstations to exchange packets of data at high rates of speed and reliability. Fixed bandwidth digital and analog video channels have been combined with computer networks to implement some video teleconferencing features. These include high bandwidth CATV/FDM type analog channels and fixed allocation TDM data channels for the video data.

SUMMARY OF THE INVENTION

Workstations today have obtained unprecedented computational power and utility. The powerful RISC type CPUs and fast, high resolution graphical displays have made possible multimedia workstations which integrate live audio and video into the programming environment. Graphical User Interface operating systems (GUI) have allowed effective integration of audio and video into application programming.

The present invention provides means for storing and retrieving synchronized audio/video "filmclips" to and from a data file of a multimedia computer workstation. The file storage apparatus and protocol of this invention provides for the storage and retrieval of high quality synchronized video and audio data in a format which is compatible with the video teleconferencing and messages of this invention. The invention uses the teleconferencing protocol of this disclosure to store an audio/video "filmclip" file similar to the way the audio and video teleconference data is sent across a network to a remote workstation during a teleconference. The teleconferencing protocol is also used to replay the audio/video "filmclip" file similar to the way the audio and video teleconference data is received across a network from a remote workstation. Advantageously, the audio and video is reconstructed from the "filmclip" file as it is serially read out of the file, so all the data in the file need not be present in the working memory of the computer before playback can occur. Timing information is embedded into the data stored in the file and provides for easy synchronization of the reconstructed audio and video. The present invention also features a video teleconferencing "answering machine" which allows a user to leave an audio/video "filmclip" message on another workstation for later playback of the message by the user of the other workstation.

In general, in one aspect, the invention features a method and apparatus for storing and retrieving audio and video data in a file accessible by a multimedia computer workstation. The computer workstations include a storage means for a workstation to store audio and video data as digital data packets to the data file, and retrieval means for the workstation to retrieve audio and video data from the data file. The data file is accessible using, for instance, a TCP/IP protocol socket.

In preferred embodiments, the storage means and retrieval means each include a software process executing on the workstation. The storage process formats and stores audio and video data to the data file as data packets, and the retrieval process retrieves the data packets from the data file and reconstructs the audio and video data stored by the storage process for audible and visual reproduction, respectively. The video data is presented as an image on the display of the workstation, while the audio data is sent to either amplified speakers or headphones.

In preferred embodiments, the storage means includes an audio storage means for storing an audio data stream from the workstation to the data file such that the audio data can be retrieved from the data file and reconstructed by the workstation into a continuous audio signal. The storage means also includes video storage means for storing video data from the workstation to the data file such that each frame of video data stored to the data file is inserted into the audio data stream also stored in the data file by the workstation without affecting the continuity of the audio signal retrieved from the data file and reconstructed by the workstation.

In still other preferred embodiments, timing information is attached to each frame of video data stored to the file. The timing information indicates a point in the continuous audio data stream which corresponds in time to the frame of video data. The retrieval means includes a synchronizer for displaying a frame of video data, retrieved from the data file, on the display of the workstation when the point in the audio data stream, retrieved from the data file, corresponding to the timing information of the retrieved video frame is audibly reproduced by the workstation. The synchronizer counts the amount of audio data retrieved in the continuous audio stream and compares the count to the timing information stored along with the most recently retrieved video frame to determine when to display the frame.

In general, in another aspect, the invention features a multimedia computer workstation, such as a RISC workstation or IBM PC, having audio/video "filmclip" storage and retrieval capabilities. The multimedia workstation of this invention includes a video source for providing sequential frames of digitized video data. An audio source provides a digitized audio data stream that represents a continuous audio signal synchronized to the sequential frames of digitized video data. Storage means provides for storing the audio and video data to a data file such that each frame of video data stored to the data file is sequentially inserted into the audio data stream without affecting the continuity of the audio signal represented by the audio data stream. Retrieval means provides for retrieving the audio data stream and the sequential frames of video data from the data file. Audio reproduction means provide for audibly reproducing the retrieved audio data stream into a continuous audio signal.

Display means provide for displaying the retrieved sequential frames of video data on the display of the workstation synchronized to the reproduced audio signal.

In preferred embodiments, the video source includes a video camera, a video tape recorder, and/or a video laser disk player providing sequential frames of analog video. A video frame grabber captures, digitizes, and stores each frame of analog video. A video compressor may compress the video data using JPEG or MPEG compression. The audio source includes a microphone for live audio, or pre-recorded audio corresponding to frames of pre-recorded video, from for instance a video tape recorder or laser disk. An audio digitizer digitizes and stores the audio using mu-law compression.

In general, in yet another aspect, the invention features a multimedia "filmclip" message storage apparatus for a video teleconferencing workstation. The message storage apparatus includes a receiver for receiving an audio and video "filmclip" message from a remote source across a digital data network as digital data packets. The receiver stores the received audio and video data packets to a "filmclip" data file accessible by the workstation. Retrieval means provide for retrieving the audio and video "filmclip" message from the data file.

Preferred embodiments of the message apparatus include means for informing a user of the workstation that an audio and video "filmclip" message has been received by the workstation. Screening means allows for monitoring the audio and video "filmclip" message as it is being received from the remote source.

In other preferred embodiments, the receiver and retrieval means each include a software process executing on a processor of the workstation. The receiver process receives the audio and video message data packets formatted by the remote source and stores the data packets to the "filmclip" data file as received from the remote source. The retrieval process retrieves the data packets from the "filmclip" data file and plays back the audio and video "filmclip" stored by the receiver process.

In other preferred embodiments, the audio message data are formatted by the remote source and stored to the data file by the workstation so that an audio data stream can be retrieved from the data file and reconstructed by the workstation into a continuous audio signal. The video data are formatted by the remote source and stored to the data file by the workstation such that each frame of video data is inserted into the audio data stream also stored in the data file without affecting the continuity of the audio signal retrieved from the data file and reconstructed by the workstation.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of preferred embodiments of the invention, as illustrated in the accompanying drawings in which like reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention.

FIG. **1** is a pictorial representation of the distributed computer system featuring multimedia workstations having video teleconferencing capabilities of this invention.

FIG. **2** is a block diagram showing a preferred embodiment of the multimedia workstation for implementing the video teleconferencing features of the distributor computer system of FIG. **1**.

FIG. **3** is a block diagram showing the software environment for implementing a preferred embodiment of a DECspin video teleconferencing application for implementing the video teleconferencing features of the system of FIG. **1**.

FIG. **3**(*a*) is a block diagram showing the implementation of a "filmclip" file for storage and playback of audio and video using the protocol of this invention.

FIG. **4** is a block diagram showing the one-way connections established between two workstations to implement a two-way video teleconference.

FIGS. **5***a*–**5***c* are block diagrams illustrating the multiple one-way video teleconferencing connections established between three workstations joined in the same teleconference.

FIG. **6** is a flowchart illustrating the flow of video during a video teleconference.

FIG. **7** is a flowchart illustrating the teleconferencing protocol of this invention for establishing a video teleconference connection between two workstations.

FIG. **8** illustrates the format of the START message of the teleconferencing protocol of this invention.

FIG. **9** illustrates the format of the OK message of the teleconferencing protocol of this invention.

FIG. **10** illustrates the format of the STARTHEADER message of the video teleconferencing protocol of this invention.

FIG. **11** illustrates the format of the QUIT message of the teleconferencing protocol of this invention.

FIG. **12** illustrates the format of the ANSWERMACHINE message of the teleconferencing protocol of this invention.

FIG. **13** illustrates the format of the CONTROL message of the video teleconferencing protocol of this invention.

FIG. **14** is a flowchart showing the audio and video data transfer sequence of the video teleconferencing protocol of this invention.

FIG. **14**(*a*) is a flowchart showing the storage of audio and video data to a "filmclip" file using the video teleconferencing protocol of this invention.

FIG. **14**(*b*) shows the resulting structure of audio and video data stored in a "filmclip" file by the process shown in FIG. **14**(*a*).

FIG. **15** shows the format of the AUDIOHEADER message of the video teleconferencing protocol of this invention.

FIG. **16** shows the format of the VIDEOHEADER message of the video teleconferencing protocol of this invention.

FIG. **17** shows a timing diagram of the audio and video data synchronization of the video teleconferencing protocol of this invention.

FIG. **18** shows the top level graphical user interface window for controlling a video teleconferencing session of this invention.

FIG. **19** shows the graphical user interface window for displaying video data received from another workstation during a video teleconferencing session of this invention.

FIG. **20** shows a second level graphical user call list interface window for establishing the video teleconferencing connections to other workstations of this invention.

FIG. **21** shows a second level control graphical user interface window for adjusting the parameters for a video teleconference of this invention.

FIG. **22** shows a second level monitor graphical user interface window for monitoring the parameters of a video teleconference of this invention.

FIG. 23 shows a second level documentation graphical user interface window for obtaining information about the operation and features of a video teleconference of this invention.

FIG. 24 shows a third level documentation graphical user interface window for obtaining information about a topic selected from the second level user interface window of FIG. 23.

FIG. 25 shows a graphical user interface window of a ring box for announcing a video teleconference call to another workstation to establish a video teleconference of this invention.

FIGS. 26(*a*)–26(*k*) show the display screens of three Workstations participating in a three-way video teleconference of this invention.

FIG. 27 is a flowchart showing the pixel decimation and replication video compression technique of this invention.

FIGS. 28(*a*)–28(*c*) show the compression and reconstruction of a frame of video data using the pixel decimation and replication technique of FIG. 27.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows a distributed computer system **10**, having a plurality of multimedia workstations **12** connected by a high speed digital network **14**, which features n-way video teleconferencing of this invention. Each of the multimedia workstations **12** is capable of producing live audio and video data for transmission across the network to another multimedia workstation. Further, each of the multimedia workstations is capable of sonically reproducing the audio data and visually reproducing the video data received from another workstation.

Two or more of the networked workstations can participate in an n-way video teleconference using the teleconferencing protocol of this invention. The teleconferencing protocol of this invention allows real time synchronized audio and video transmission across the network without the use of a fixed bandwidth or dedicated time slot transmission medium. Rather, this invention provides high performance video teleconferencing features using standard digital network transport level protocols such as Internet TCP/IP and UDP/IP, or DECnet™. The physical network link **14** should be a high speed FDDI (Fiber Distributed Data Interface) fiber optic link running at 100 MB/Sec. for maximum performance (about 15 uncompressed black and white frames per second), but can also be virtually any type of high quality digital network link such as an Ethernet™. In the case of the FDDI network link, performance is typically limited by the workstation hardware and software, rather than by the throughput of the network. In addition, wide area networking (WAN) technologies, such as T1 and T3 digital carriers, can be used with the video teleconferencing protocol of this invention. These WAN technologies can be expected to achieve a video frame rate of at least about 12 Hz, assuming black and white video images compressed with JPEG, MPEG, or another video compression technique. The features of one preferred embodiment of this invention are commercially embodied in the DECspin™ product available from Digital Equipment Corporation, Maynard, Mass., the assignee of this patent application.

FIG. 2 shows a preferred embodiment of the multimedia workstation **12** for implementing the video teleconferencing protocol of this invention. Workstation **12** includes a high performance processor **20** connected to a large working memory **22** having 24 megabytes or more capacity, and a large hard drive having 1 gigabytes or more capacity. A high performance backplane channel **26** connects the processor, memory, and hard disk to other devices in the workstation.

The workstation is coupled to the digital network communications link **14** through a network controller **28** connected between the network link **14** and the backplane channel **26**. The workstation is also coupled to a voice grade telephone line **29** through a modem **31** connected between the backplane channel and the telephone line. Similarly, the workstation can be connected to other digital data conversation services, such as the ISDN digital telephone network.

Multimedia workstation **12** includes a color video frame grabber **34** for capturing and digitizing frames of video from one or more analog video inputs **36**. Video inputs **36** are each connected to a video source, such as a video camera **38** providing live analog video signals, or an auxiliary video storage device **40**, such as a VCR or video laser disk player providing stored analog video signals. The analog video signals may be of any standard types such as NTSC, SECAM, or PAL.

The multimedia workstation **12** also includes a video buffer **35** which stores a frame of full color video graphics and characters generated by the workstation for display on a 1280x1024 pixel color monitor **30**. The video buffer **35** (and associated buffer controller) is connected to the backplane channel **26** for receiving video data from the processor **20**. The video buffer is also connected to a video display subsystem **36** which converts the stored video frame data into analog signals for driving the color monitor **30**.

The video frame grabber **34** stores its digitized video data directly into a predetermined area of the video buffer **35**. Thus, the digitized video input to the workstation by the frame grabber appears directly in a predetermined area on the monitor **30**, without having to pass through processor **20** or main memory **22**. Further, processor **20** can read back the captured video frame data from the video buffer, store the data in main memory **22**, and further process the video data according to the video teleconferencing protocol described herein.

Frame grabber **34** digitizes and stores each frame of video from an analog video source and can deliver up to 30 frames per second of digitized 640x480 true color (24 bits) of NTSC/SECAM/PAL video into video frame buffer **35**. A dedicated hardware video compression subsystem **37** can also be connected to the backplane channel **26** to provide high performance video compression of the digitized video data.

The audio features of the multimedia workstation **12** are implemented using an audio controller **42** connected to the backplane channel **26** for interfacing audio signals into the workstation and reproducing audio signals out of the workstation. An audio distribution box **44** is connected to the audio controller for directing audio to and from audio devices such as a microphone **46**, a headphone **48**, and/or a telephone receiver **50**. Auxiliary audio devices such as a recording device, a CD player, or amplified speakers may also be connected to the distribution box **44**. Audio controller **42** receives audio input from the distribution box and digitizes the audio using an 8 bit mu-law encoder at 64 kbits per second or less to match typical telephone voice grade audio standards (8 kHz bandwidth). For convenience, the headphones **48** and microphone **46** may be combined into a single headset.

In one commercial embodiment available from Digital Equipment Corporation, multimedia workstation **12** is built around a DECstation™ 5000/200 workstation in which

processor 20 is an R3000™ RISC processor and backplane channel 26 is a TurboChannel™ (TC) bus. Network controller 28 is a DEC FDDIcontroller 700™. Frame grabber 34/video buffer 35/video display subsystem 36 is a DECvideo/in™ TurboChannel compatible video system, and audio controller 42 is a DECaudio™ TurboChannel compatible audio controller.

Alternatively, multimedia workstation 12 can be built around a person computer platform, such as an IBM™ compatible PC. Preferably, the PC should have a high speed Intel 80386™, 80486™, or successor processor. The PC should be compatible of running in the Microsoft Windows™ or Windows NT™ graphical operating system environment.

Workstations and PCs of different performance levels can all participate in the same video teleconference using the video teleconferencing protocol of this invention. For instance, less powerful or slower PC's and workstations can simply communicate at a slower video rate with the more powerful workstations, without affecting the overall video rate between other workstations.

The effective video frame rate of a video teleconference depends to a large extent on the quantity of video data handled by a workstation during each video frame. Video compression techniques can greatly enhance the effective frame rate of the video teleconference especially over lower data transfer rate services such as ISDN. Standard compression methods such as JPEG (Joint Photographic Experts Group), MPEG (Motion Picture Experts Group) and Px64 can be implemented using a dedicated hardware subsystem 37 which have recently become available.

A video compression technique which has been found useful for use with the video teleconferencing protocol of this invention features pixel decimation and replication (PDR). This PDR technique effectively subsamples by ½ a full frame of video pixels in the vertical (Y) and horizontal (X) directions. Thus, a frame of video captured by the frame grabber is reduced to one quarter of its original size. The subsampling is accomplished by a scaling function featured on the frame grabber 34 of FIG. 2.

Reconstruction of the image is implemented in software by replicating every pixel received twice along a line, and then replicating the reconstructed line as the next line of the restored image. The replicated line is shifted by a single pixel to prevent any pixel block patterns from forming. Results have shown acceptable quality of the received image, while offering significantly increased system throughput and performance.

FIG. 3 shows a diagram of the DECspin™ product software system environment for a preferred embodiment of this invention. Generally, the Digital Teleconferencing Protocol (DTP) is implemented. by a DECspin™ application program 60 which resides at the application layer of the standard ISO 7-layer network model. The DTP video teleconferencing protocol of this invention is used to transfer audio and video data between workstations, as well as between local applications (loopback), and for storing and retrieving audio and video data to and from a disk file.

The DECspin application program 60 runs on top of an Ultrix™ (V4.2a or its successors) (UNIX™) 62 operating system. All communications between the DECspin application 60 and the UNIX operating system 62 are handled via UNIX system calls 64. The DECspin application program 60 is written as an X Windows™ application running under a Motif™ X Windows manager. A description of the Ultrix, X Windows, and X11 programming environments can be found in "ULTRIX Worksystem Software, X Window System Protocol: X Version 11," Digital Equipment Corporation, order number AA-MA98A-TE, Maynard, Mass. (1988, Version 2.0), the contents of which are incorporated herein by reference. A description of the Motif programming environment can be found in Open Software Foundation, "OSF/Motif Programmer's Guide," Prentice Hall, Englewood Cliffs, N.J. 07632 (1991, Revision 1.1), the contents of which are incorporated herein by reference.

Through UNIX system calls the DECspin application establishes local TCP/IP "sockets" for communication with various software servers providing multimedia services for the DECspin application. The creation and use of UNIX "socket" system calls for creating TCP/IP application connections is discussed in detail by Comer, D.E., "Internetworking With TCP/IP, Vol. 1: Principles, Protocols, and Architecture, Second Edition" Prentice Hall, Englewood Cliffs, N.J. (1991) (pp 337–346), the contents of which is incorporated herein by reference. The DECspin application communicates with an audio server application 66 which provides audio services using X Windows Xmedia commands 68 through a local TCP/IP "socket". The DECspin application communicates with a video X Windows Xserver application 70 which provides video services using X11 and XV extension commands 72 through another local TCP/IP "socket". DECspin communicates with a Motif based graphical user interface (GUI) 74 through yet another local TCP/IP "socket".

The DECspin application communicates with a DECspind "slave" application 78, running on either the local or a remote workstation using the DTP video teleconferencing protocol 80 via another "socket". The DECspind application is a UNIX "deamon" version of the DECspin application which is "slaved" to a DECspin "master" application running on either the local or a remote workstation. The DECspind application is used to receive, reconstruct, synchronize, and display audio and video data sent to it from either a local or remote DECspin application using the DTP protocol. Where the DECspind application is operating on the local workstation, the "socket" is a local TCP/IP "socket". Where the DECspind application is operating on a remote workstation, the "socket" can be either a remote TCP/IP or DECnet "socket".

Furthermore, as also shown in FIG. 3(*a*), the DECspin application 60 can store audio and video data to a system "filmclip" file 82 using the DTP video teleconferencing protocol via another local TCP/IP "socket" 84. This creates a stored "filmclip" audio and video data stream which can be played back from the "filmclip" file 82 using a DECspind application 78. That is, a DECspind application 78 creates a local TCP/IP "socket" 83 to the stored file, receives data through the socket via the same DTP protocol and plays back the stored audio and video to the user. This is the equivalent of the DECspind application receiving the audio and video data directly from a DECspin application via the DTP video teleconferencing protocol, but without the acknowledgement protocol discussed below.

FIG. 4 shows a schematic model of two workstations 12*a* and 12*b* connected across network 14 during a two-way video teleconference run under the DECspin application. Each "two-way" video teleconferencing connection established between two workstations is composed of separate "one-way" connections. Each one-way connection operates in a "data pushing" mode. That is, audio and video data are "pushed" from the originating workstation to the receiving workstation. This "push" model provides a high degree of security since it prevents another network user from

remotely activating workstation's audio and video from across the network.

To originate a video teleconference call to another workstation, a first workstation **12***a* (Workstation A) executes a local DECspin application program **100** which acts as a "master". DECspin "master" **100** first establishes a one-way network connection **102** with a second workstation **12***b* (Workstation B) by invoking execution of a DECspind "slave" application program **104** on Workstation B. Digitized audio and video data are sent from Workstation A by DECspin application **100** to Workstation B where they are received by the DECspind application **104**. Furthermore, DECspind application **104** signals **106** the user of Workstation B to indicate that a video teleconference call has been received from Workstation A. In response to the signal, a local DECspin "master" application program **108** on Workstation B establishes a separate one-way network connection **110** with Workstation A by invoking execution of a DECspind "slave" application program **112** on Workstation A. If the DECspin application **108** on Workstation B is not currently executing when the signals **106** occur, the DECspin application **108** is executed and places a return call to Workstation A. The return call to Workstation A causes the execution of DECspind application program **112**. Audio and video signals from Workstation B are sent by DECspin application **108** to Workstation A where they are received by DECspind application **112** to complete the two-way video teleconferencing connection between the workstations.

FIG. **5***a* symbolically shows the two one-way video teleconferencing connections of FIG. **4** between Workstation A and Workstation B. FIGS. **5***b* and **5***c* symbolically show the addition of a third workstation **12***c* (Workstation C) to the video teleconference. As shown in FIG. **5***b*, Workstation A first establishes a video teleconference with Workstation C independent of Workstation A's video teleconference with Workstation B. This new video teleconference is invoked by Workstation A in a manner identical to the invocation of the conference between Workstation A and Workstation B as shown in FIG. **4**, i.e., by creating two one-way connections **102***a* and **110***a* between the workstations using DECspin and DECspind application programs running on the two workstations.

Once a video teleconference between Workstation A and Workstation C is established, Workstation C and Workstation B likewise establish two one-way connections **102***b* and **110***b* as shown in FIG. **5***c* to complete the video teleconferencing connections. This can occur by either Workstation B calling Workstation C, or by Workstation A "joining" all the workstations into the same conference by sending a "join" control message to each of the other workstations. Upon receipt of the "join" message, each workstation places a call to each other, unconnected workstations. Thus, each workstation participating in a particular video teleconference establishes and maintains a two-way video teleconference connection with each other workstation in the teleconference. In this manner, a teleconference participant can control what each other participant receives from that workstation, e.g., muting audio or pausing video to certain participants while remaining active to other participants. Furthermore, if a participant has a workstation which can only operate at a limited capacity, each participant can treat that workstation differently from the other workstations, without affecting the overall performance of the video teleconference for the other participants. For example, an audio only workstation can still participate in a teleconference without affecting the video distribution among the other workstations.

It should be noted that each workstation will run only a single DECspin application, which may establish a connection with one or more remote workstations. However, each workstation will execute one DECspind "slave" application session for each workstation to which a video teleconference connection is established. That is, each workstation runs a single DECspin "Master" application, but may run multiple DECspind "Slave" applications simultaneously.

In one preferred embodiment, a single "master" DECspin application can be connected to up to seven DECspind "slave" applications simultaneously. Further, all the DECspind applications need not be members of the same video teleconference. For instance, one workstation may simultaneously be connected to two separate video teleconferences, one with three members and one with four members, for a total of seven DECspind applications driven from a single DECspin application. The members of each conference can only see and hear the members of the same conference. Any workstation common to both conferences can "join" the conferences, in which case all seven members will be joined into a single conference where all can see and hear each other.

FIG. **6** is a block diagram showing the flow of video from one workstation to another. The video data source (**38** or **40** of FIG. **2**) provides standard NTSC, SECAM, or PAL analog video signals **200** which are digitized and stored **202** in a video frame buffer **35** by the frame grabber **34** (FIG. **2**). Once an entire video frame has been digitized and stored in the frame buffer, the entire frame of video data is transferred **204** to an application buffer in main memory **22** (FIG. **2**) which is assigned to the DECspin application. Once the video data has been transferred to the application buffer, the video frame grabber can begin to digitize and store the next video frame in the frame buffer.

The digitized video data in the DECspin application buffer is next packaged for decoding and reconstruction by the receiving DECspind application, and is sent to the network transport buffer **206**. The video data in the network buffer are packetized according to the network protocol in use, e.g., TCP/IP or DECnet, sent **208** across the network, and received **210** into a receiving network buffer. The video data is reconstructed from the network protocol packets and sent **212** to a DECspind application buffer in main memory **22** (FIG. **2**) of the receiving workstation. The video data are accumulated into the DECspind application buffer until a full frame of video has been received. Graphics are added to the video to form a composite video image for display. The composite video image is then sent **214** to the frame buffer from which the digitized composite video image is converted for display **216** on the workstation monitor.

FIG. **7** is a flowchart showing the commencement of a video teleconference between a local workstation, Workstation A, and remote workstation, Workstation B. To begin a teleconference, the user of Workstation A invokes **300** the execution of the local DECspin application. The executing DECspin application causes the creation of a network "socket" **302** through a standard UNIX system call. Creation of the socket on Workstation A causes the creation of a corresponding "port" **304** on the remote Workstation B. This "socket-to-port" connection establishes a peer-to-peer connection for the DECspin and DECspind applications running on the two-connected workstations. That is, data put into the "socket" on Workstation A are transferred to the port on Workstation B via a standard network protocol such as TCP/IP or DECnet. UNIX treats the established socket as a standard file descriptor to which the DECspin application simply sends the data stream to be transferred to Workstation B. Thus, this data transfer operation is transparent to the DECspin application which simply accesses the "socket" through standard UNIX calls.

Once the "socket" to Workstation B is established, DECspin sends a START message **306** through the "socket" to Workstation B. FIG. **8** shows the format of the START message, which is simply a two byte long data string.

Upon receipt of the START message, Workstation B invokes execution **308** of a DECspind "slave" application which connects to the previously created port **304** to receive data from the "socket" on Workstation A. Once the DECspind application verifies **310** this end-to-end connection between the two workstations, DECspind sends **312** an OK acknowledgement message through the "port" back to the DECspin application. FIG. **9** shows the format of the OK message, which is simply a two byte data stream.

Upon receipt of the OK message from the "socket," the DECspin application sends **316** a STARTHEADER message through the "socket" to the DECspind application which is used to set up **318** the parameters for the current video teleconferencing session. FIG. **10** shows the format of the STARTHEADER message, the fields of which convey the parameter information required by the DECspind application. These parameter fields include a video width field **400** and a video height field **402** for setting the initial DECspind picture size. A bits per pixel field **404** sets DECspind to display either a black and white image (8 bits) or a true color image (24 bits). A frame rate field **406** sets the desired initial frame rate. A frame count field **408** sets the number of frames expected to be sent during the video teleconference. The value of this field is set to −1 for a live video teleconference (to indicate infinity) where the total number of frames to be sent is indefinite. Otherwise, the actual number of frames to be transferred during the session is entered into the field, e.g., for a video message of predetermined duration. A login/user handle field **410** identifies the calling party and is used by DECspind to set up the return audio and video connections from Workstation B to Workstation A. Finally, a DTP (DECspin teleconference protocol) flag field **412** conveys multiple single bit flags which indicate particular operational modes such as video compression type used (if any) audio encoding type used, whether to expect audio, video, or both, or how DECspind should respond to certain commands.

Once DECspind receives the STARTHEADER and determines **320** that it will participate in the video teleconference with Workstation A, it issues another OK message to the DECspin application on Workstation A. The receipt **322** of this OK message causes the DECspin application to begin transmission **324** of audio and video data to the DECspind application on Workstation B.

Furthermore, when the user answers the call the DECspind application invokes execution of its own local DECspin application, which establishes a return connection for sending return audio and video data from Workstation B to Workstation A, to complete the two-way video teleconference. The DECspin "master" application now running on Workstation B establishes communications with a DECspind "slave" application on Workstation A in a process equivalent to that just described with respect to establishing communications between workstation A and workstation B. In this case, however, Workstation B is viewed as the local workstation, and Workstation A is viewed as the remote workstation.

With respect to the invocation **326** of the DECspin application on Workstation B, this may occur in one of two ways. If there is no DECspin application currently running on Workstation B, then DECspind initiates execution of the DECspin application, and passes the required parameters to the DECspin application through the application invocation command line. If the DECspin application is already running on Workstation B (e.g., supporting another video teleconference in progress), the DECspind application will append the parameters received via the STARTHEADER message into an information file used by the executing DECspin application. This information file is in turn used to control execution of the DECspin application. Only one DECspin application may be executing on a workstation at one time. However, multiple DECspind applications may be running on the same workstation.

Alternatively, if the DECspind application running on Workstation B receives the STARTHEADER message and the user does not want to, or cannot participate in the video teleconference, the workstation returns **228** a QUIT message to the DECspin application on Workstation A. FIG. **11** shows the format of the QUIT message, which is a two byte data string. Upon receipt of the QUIT message, the DECspin application on Workstation A terminates the connection with the DECspind application on Workstation B.

As another alternative, the DECspind application running on Workstation B can respond to the STARTHEADER like a telephone answering workstation by returning an ANSWERMACHINE message back to the DECspin application. FIG. **12** shows the format of the ANSWERMACHINE message which is also a two byte data string. The DECspin application running on Workstation A allows the user to respond to the ANSWERMACHINE message by sending a fixed length (typically 20 seconds) audio and video message to the DECspind application on Workstation B where it is stored in a "filmclip" file for deferred playback by the user. The audio and video message may also be viewed by the user of workstation B as it is arriving for storage, similar to "screening" an incoming telephone call.

FIG. **13** shows the format of a CONTROL message, the fields of which convey control information and commands between workstations participating in a video teleconference. Specifically, a two byte identifier field **450** identifies the CONTROL message. At which field **452** identifies the type of control message to follow, and a length field **454** indicates the length of the control message. A flag field **456** conveys other information about the CONTROL message to the receiving workstation, for instance whether or not an acknowledgement message should be sent to the originator of the CONTROL message upon its receipt.

One type of CONTROL message is a "JOIN" message. This message is sent by a local workstation to all remote workstations currently participating in a video teleconference with the local workstation to join all the workstations into the same video teleconference. As discussed above, a workstation may carry on more than one video teleconference simultaneously without the other participants being connected to each other. Upon receipt of a "JOIN" CONTROL message, each of the remote workstations places a video teleconference call to each of the other remote workstations which are currently connected to the local workstation but not to that remote workstation. In this manner, individual dual one-way video teleconferencing connections are established between each of the workstations that has been "joined" into the teleconference. It should also be noted that any workstation can leave the teleconference without affecting the teleconference among the removing workstations by simply terminating its video teleconference connection to each of the workstations.

FIG. **14** is a flowchart showing the synchronized transmission of digitized audio and video data from a DECspin

application running on a local workstation, Workstation A, to a DECspind application running on a remote workstation, Workstation B. Video data are collected on a continuing frame by frame basis. One frame is collected and stored in the frame buffer of the frame grabber **34** (FIG. **2**) until the frame is transferred to the DECspin application buffer in main memory **22** (FIG. **2**) for transmission across the network to a DECspind application, or until the frame is discarded to make room for collection of a new video frame. Digitized audio data are collected into an audio data buffer. The audio data is drawn out of the audio buffer by the DECspin application which sends the audio data as a continuous stream to the DECspind application.

The audio and video data sent across the network can be modeled as frames of video data inserted into a continuous stream of audio data. In general, the DECspin application will not discard audio data, but will discard video frames as necessary. Since the ear differentiates sound and the eye integrates images, breaks in the audio are more objectionable to a listener than breaks in the video are to a viewer. As a result, the highest priority of the DECspin application is to deliver a continuous, unbroken digitized audio stream to the DECspind application. On the other hand, video frames are routinely discarded dependent on network throughput, and other workload factors.

After a video frame has been digitized and stored in the frame grabber buffer, the frame is made available **350** to the DECspin application for transfer to the DECspind application running on Workstation B. Digitized audio stored in the audio buffer, up to the time when the frame becomes available, is sent **352** first to the DECspind application. The DECspin application begins the audio data transmission by sending an AUDIOHEADER message through the "socket" to the DECspind application. FIG. **15** shows the format of the AUDIOHEADER message, the fields of which convey information about the audio data to follow. Specifically, a two byte identifier field **414** identifies the AUDIOHEADER message, a length field **416** indicates the amount of digitized audio data to follow the AUDIOHEADER message, and an audio flag field **418** indicates parametric information about the audio data. One such audio flag, for instance, indicates the type of audio encoding used to digitize the audio signal, e.g., mu-law encoding. Packets of up to 16 kB each of audio data are then sent to the DECspin "socket" immediately following the AUDIOHEADER message. The audio data packets are reassembled into a continuous audio data stream by the receiving DECspind application, and the audio is sonically reproduced.

Next, the frame of available video data **350** is sent **354** from the DECspin application to the DECspind application immediately following the audio data. The DECspin application begins the video frame transmission by sending a VIDEOHEADER message through the socket to the DECspind application. FIG. **16** shows the format of the VIDEOHEADER message, the fields of which convey information about the frame of video data to follow. Specifically, a two byte identifier field **420** identifies the VIDEOHEADER message. A video width field **422** and video height field **424** indicate the size of the video frame to follow the VIDEOHEADER message. A control flag field **426** conveys parametric information about the video data frame. Finally, a timing information field **428** carries a time stamp which helps the DECspind application to realign the audio and video data for synchronized reconstruction at workstation B. The time stamp is a numerical value corresponding to the byte count of the continuous audio stream taken at the end of the current video frame.

A full frame of digitized video data is sent from the DECspin application to the DECspind application immediately following the VIDEOHEADER message. The DECspin application then stops sending data through the "socket" **356** until it receives an OK message (FIG. **9**) from the DECspind application which acknowledges receipt and successful reconstruction of the full video frame.

The video frame data are broken into data packets of 32 kB or less to facilitate efficient transmission through the "socket" and across the network by the TCP/IP protocol. Although the video data could be sent through the "socket" as a single, unbroken stream of approximately 300 kbytes of data (for a black and white image having 640 by 480 pixels, each 8 bits deep), any error occurring at the TCP/IP protocol level would require retransmission of the entire 300 kbyte data stream. Therefore, by breaking the data into smaller 32 kbyte maximum size packets, any error at the TCP/IP protocol level will only require retransmission of at most 32 kbytes of video data. This significantly increases the efficiency of video transmission across the network which results in a higher overall video throughput.

The DECspind application collects the received video data packets into an application buffer until an entire frame of video data has been collected. At that time, the DECspind application proceeds to display the received video frame to the workstation user, and issues an OK message (FIG. **9**) to the DECspin application to acknowledge receipt and successful reconstruction of the video frame.

The DECspin application responds to the OK message sent by the DECspind application in one of three ways. The response depends on when the OK message is received relative to the time required for the video frame grabber to make the next video frame available, i.e., "the frame time" between available frames. FIG. **17** illustrates the timing and operations associated with the receipt of the OK message by the DECspin application, and is discussed in detail below.

The first situation occurs when DECspin receives the OK message within two frame times **358** (FIG. **14**) of sending the last available video frame to the DECspind application. In this case, DECspin returns **360** to determine if **350** a new video frame is available from the frame grabber buffer, and the entire process of sending audio and video data to the DECspind application is repeated.

The second situation occurs when DECspin receives the OK message beyond two frames times **362**, but less than a "time out" time period, after sending the last available video frame to the DECspind application. In this case, DECspin first sends **364** the digitized audio accumulated in the audio buffer to the DECspind application to prevent loss of this audio data which would result in a break in the continuity of the reconstructed audio. DECspin then proceeds to return **360** and determine **350** if a new video frame is available from the frame grabber buffer for transmission, and the entire process of sending audio and video to the DECspind application is repeated.

The third situation occurs when the DECspin application has not received an OK message within a specified "timeout" period **366**. In a preferred embodiment, the timeout period is set at one half second. A timeout can occur when, for instance, the network is reset, or a processor intensive operation is being performed at the receiving workstation which competes with the DECspind application for workstation resources. In timeout situations, loss of part of the continuous audio signal as well as part of the video signal is unavoidable. In this case, the DECspin application continually trims **368** the audio buffer to only retain audio data

corresponding to the last time out interval, which prevents overflow of the audio buffer. For instance, where the timeout interval is one half second, DECspin only retains the last one half second of audio data in the audio buffer. Finally, when DECspin receives the OK message **370** from the DECspind application, DECspin first sends **364** the last half second of digitized audio accumulated in the audio buffer, and then proceeds **360** to determine **350** if a new frame of video data is available from the frame grabber buffer, and the entire process of sending audio and video to the DECspind application is repeated.

FIG. **17** illustrates a more detailed timing analysis of these three video frame acknowledgement situations. At time t_0, the frame grabber begins to capture a digitized video frame in its buffer, which becomes available for transmission by the DECspin application at time t_1. At time t_1, video FRAME1 is transferred from the frame grabber buffer to the DECspin application buffer in main memory, and the frame grabber begins to accumulate the next frame FRAME2, in the frame grabber buffer.

The DECspin application then begins to send the audio and video data to the DECspind application shortly after time t_1. If the acknowledgement OK message for FRAME1 is received from DECspind before the next video frame, FRAME2, is available at time t_2, i.e., during the ACK1 interval, then DECspin waits until time t_2 to begin sending the audio and video FRAME2 data. If the acknowledgement OK message for FRAME1 is received from DECspind after FRAME2 is available at time t_2 but before the next video frame, FRAME3, is available from the frame grabber buffer at time t_3, i.e., during the ACK2 interval, then DECspin begins immediately sending the audio data accumulated in the audio buffer and video frame FRAME2 to the DECspind application.

In the case where the acknowledgement OK message is received greater than two frame times after video frame FRAME1 became available from the frame grabber buffer at time t_1, e.g., after time t_3 during the ACK4 time interval, the currently available video frame is FRAME3 which became available at time t_3. Since the frame grabber has only a single frame buffer, the FRAME2 data is discarded, and not sent to the DECspind application. In this manner, only the freshest video frame is sent across the network. Regardless of when the OK message is received after the two frame timeout limit, the last available (and freshest) video frame is sent to the DECspind application, and all other intervening video frames are discarded. The last available video frame is sent shortly after the OK message is received.

The DECspind application synchronizes the received audio data stream with the video frame data to be displayed by comparing the audio data stream to the time stamps of the received video frame data. Due to system time delays and the order of audio and video data transmissions, a frame or video will be available for display by the DECspind application prior to reproduction of its corresponding audio. A typical system time delay is about ¼ to ½ second for the audio signal. Audio data received by the DECspind application is accumulated into a DECspind audio buffer, and read out for sonic reproduction on a continuous basis. DECspind keeps track of the number of audio data bytes received from the DECspin application, and thus generates a continuously updated audio time stamp. As discussed above, each video frame is preceded by a VIDEOHEADER (FIG. **16**) message which includes a timing information field **428** holding a time stamp value corresponding to the audio byte count at the end of that video frame time. DECspind reads this time stamp information and delays displaying the associated reconstructed video frame until an audio time stamp generated from the received audio data stream matches the video frame time stamp. The video frame is displayed when the match occurs. In this manner, the audio always appears to be synchronized to the displayed video frames, regardless of the video frame rate or the loss of intervening video frames.

FIG. **14**(*a*) is a flowchart showing the procedure for storing synchronized audio and video data to a multimedia "filmclip" file accessible by a local workstation. This procedure is similar to the synchronized transmission of audio and video data between two workstations represented by the flowcharts of FIGS. **7** and **14**.

A user of the workstation begins storage of a "filmclip" file by invoking **300***a* the execution of a local DECspin application. The executing DECspin application causes the creation of a local TCP/IP "socket" **302***a* to the target "filmclip" file through a standard UNIX system call. The target file can reside on the local workstation hard drive **24** (FIG. **2**) or on a networked file server accessible through the workstation network interface. In the case of a "filmclip" file created as an "answering machine" message on another remote workstation, the target file resides in the message area of the remote workstation and is accessed from the local workstation by a remote TCP/IP "socket".

Once the "socket" to the "filmclip" file is established, DECspin sends **316***a* a STARTHEADER message (FIG. **10**) through the "socket" for storage in the file. This stored message serves to store the format of the audio and video data and is used to setup the DECspind application which will playback the audio and video data from the file.

Next, audio and video data are stored to the "filmclip" file in a serial fashion. Video data are collected on a continuing frame by frame basis. After a video frame has been digitized and stored in the video buffer **35** by the frame grabber **34** (FIG. **2**), the digitized frame is made available **350***a* to the DECspin application for storage in the "filmclip" file. Digitized audio stored in the audio buffers up to the time when the video frame becomes available, is stored first **352***a* to the "filmclip" file. The DECspin application begins the audio data storage by sending an AUDIOHEADER message (FIG. **15**) through the "socket" for storage in the "filmclip" file. Packets of up to 16KB each of audio data are then stored to the "filmclip" file immediately following the AUDIOHEADER message.

Next, the frame of available video data is stored **354***a* to the "filmclip" file by the DECspin application immediately following the audio data. The DECspin application begins storage of the video frame by first sending a VIDEOHEADER message (FIG. **16**) through the "socket" for storage in the "filmclip" file. A full frame of digitized video data is then stored to the "filmclip" file immediately following the VIDEOHEADER message.

Next, the DECspin application determines **355** if it is done storing data to the "filmclip" file. If the DECspin application is done, then it closes **357** the TCP/IP "socket" to the "filmclip" file. If the DECspin application has more data to store to the "filmclip" file, the application returns **360***a* to determine if a new video frame is available **350***a* from the frame grabber buffer, and the entire process of storing audio and video data to the "filmclip" file is repeated.

FIG. **14**(*b*) shows the resulting structure of the audio and video data stored in a "filmclip" file **82** by the DECspin application process of FIG. **14**(*b*). A STARTHEADER data block **380** stores the STARTHEADER message first stored (**316***a*, FIG. **14**(*a*)) to the "filmclip" file by the DECspin

application. Next, an AUDIOHEADER **382** and corresponding audio data **384** data blocks hold audio buffer data stored (**352***a*) by the DECspin application. Next, a VIDEOHEADER **386** and corresponding video data **388** data blocks hold a frame of video data stored (**354***a*) by the DECspin application. The pattern of AUDIOHEADER 382_n, audio data 384_n, VIDEOHEADER 386_n, and video data 388_n data blocks repeat in sequence until the end of the file.

To replay the audio and video data from a "filmclip" file, the user of the workstation invokes the execution of a DECspind application. The DECspind application opens a TCP/IP "socket" to the "filmclip" file and reads the data serially from the file as if receiving the data directly from a DECspin application.

Graphical User Interface

FIG. **18** shows a graphical user interface (GUI) window **510** displayed on the monitor of a workstation **12** (FIG. **2**) for controlling a DECspin video teleconferencing session. Teleconferencing session window **510** is generated by the DECspin application using X Windows managed by a Motif manager, and is displayed as a graphic window on the color monitor **30** of the multimedia workstation **12** (FIG. **2**). DECspin session window **510** provides the user of a networked multimedia workstation with an interface for accessing the top level video teleconferencing functions of the DECspin application.

When a user invokes the DECspin application to begin a video teleconference through, for instance, a UNIX command, the DECspin session window **510** appears on the workstation color monitor. A window title bar **511** identifies the DECspin application and version number to the user. From this point on, all teleconferencing functions are accessed through the graphical interface associated with this and other Motif managed X Windows graphics. Furthermore, through this graphical interface, the user can also store and playback audio/video "filmclip" messages.

DECspin application window **510** includes a Motif menu bar **512** having a plurality of user selectable "pushbuttons" **514**, **516**, **518**, **520**, and **522**. These "pushbuttons" are presented as a Motif RowColumn widget which controls all the top level DECspin functions available to the user. Each of the "pushbuttons" presented to the user through the Motif windows are activated with a graphical pointing device such as a mouse. A "pushbutton" may for instance be activated by moving the mouse to cause a graphical pointer to enter the area of the pushbutton to select that button, and then activating a mechanical switch on the mouse to activate the corresponding "pushbutton". Furthermore, the "pushbuttons" also lend themselves to use with a touch screen display, where the user simply touches the "pushbutton" on the screen to activate it. An activated "pushbutton" is highlighted to indicate activation.

The DECspin graphical user interface has no first or second level language specific functional controls, and thus DECspin appears to the user as an internationalized application. As such, all top level function pushbuttons **514–522** of menu bar **512** are identified by iconic symbols which have been internationalized where possible.

Activation of one of the Motif "pushbuttons" of menu bar **512**, in most cases, causes creation of a second level pop-up window. The second level pop-up window in turn, offers the user next level of functional choices associated with the selected top level function.

An audio help, or "talking button", feature is also associated with the Motif "pushbuttons" available for selection by the user. By simultaneously selecting a Motif "pushbutton" while holding down a keyboard "help" key, a stored audio message is audibly reproduced which describes the function of the selected "pushbutton".

A live video image appears in a video window **524** displayed below the menu bar **512**. Video window **524** displays the current local image being generated by the frame grabber **34** (FIG. **2**) and stored in the video frame buffer **36** (i.e., video window **524** frames that section of the display memory frame buffer in which the video grabber stores each frame of video.) The video window acts as a video "monitor" for viewing local video throughout the video teleconference session. Furthermore, the size of the video window **524** can be changed by using the mouse to move a side or corner of the window. Changing the size of the video window affects the number of pixels encompassed by the window, and thus the number of video pixels to be sent to another workstation during each video frame. Smaller windows achieve a higher frame rate since less data per frame must be sent. Conversely, larger windows achieve a lower frame rate. Thus, the video frame rate for a video conference connection can be adjusted by simply sizing video window **524**.

When a called workstation invokes the "slave" DECspind application to receive audio and video from a calling DECspin application, the DECspind application displays a DECspind session window **850** as shown in FIG. **19**. The DECspind session window appears similar to the DECspin session window **510** of FIG. **18**, except that the title bar **852** displays the identification of the calling party, and the menu bar **854** can contain only an "exit" pushbutton **856**. A video window **858** displays the video data received from the DECspin application. Unlike the video window **524** of the DECspin session window **510**, video window **858** of the preferred embodiment is not resizable to change the video resolution since its size depends on the resolution of the video data sent by the "Master" DECspin application. Furthermore, since the video teleconferencing parameters are set by the "Master" DECspin application, no functional controls are provided other than an "exit" control which when activated will terminate the video teleconferencing connection. As an alternative preferred embodiment, a "control" pushbutton can be added to the DECspind session window, which when activated offers the user a limited control set for adjusting the received video image or audible levels. Furthermore, a "monitor" pushbutton can also be added to allow the user to monitor, for instance, the data rate of the incoming video teleconference associated with the DECspind session window.

Referring again to the DECspin application session window **510** of FIG. **18**, a functional description of the menu bar **512** "pushbuttons" is as follows. The "exit" pushbutton **514** when activated forces all video teleconferencing connections to the workstation to cease, and for the DECspin application to terminate. Any necessary cleanup of network connections is also done. If any changes to the DECspin configuration occurred during the video teleconference session, a pop-up Motif question box (not shown) prompts the user to either save the changes, restore default settings, or quit. The icon which identifies the "exit" pushbutton **514** is the international symbol for "exit" (i.e., a green circle with a vertical white bar on a white background). This symbol is used on all DECspin pop-up windows to indicate the pushbutton that causes the user to exit that particular pop-up window.

The "connections" pushbutton **516** is used to establish video teleconference connections between workstations. When activated, this pushbutton causes creation of a second level "call list" pop-up window **600** as shown in FIG. **20**.

Through the "call list" window the user can add, delete, activate or modify network video teleconferencing connections to other networked workstations. The user can also create and store an audio/video "filmclip" file through this pop-up window. The "connections" pushbutton icon is an international symbol showing a black grid with four intersection points on a white background.

The "control" pushbutton **518** is used to adjust various parameters associated with the audio and video data generated by the workstation and sent to the other video teleconferencing participants. Activation of this pushbutton causes creation of a second level "control" pop-up window **650** as shown in FIG. **21**. Through the "control" window the user can adjust transmission parameters including the maximum video frames per second, video hue, video color saturation, video brightness, video contrast, audio volume, and microphone gain. The user can also select between video compression, on or off; color or black and white; and, transmission source, live or stored.

The "monitor" pushbutton **520** is used to view various teleconferencing and network system parameters. Activation of this pushbutton causes creation of a second level "monitor" pop-up window **700** as shown in FIG. **22**. Through the "monitor" window, the user can monitor the average video frames per second transmission rate, the average network resources consumed by the active DECspin video teleconference, the number of video conference participants, the number of active audio and video connections, and the pixel resolution of the video image generated by the local workstation.

The "help" pushbutton **522** is used to access DECspin on-line documentation. Activation of this pushbutton causes creation of a second level "information" pop-up window **750** as shown in FIG. **23**. Through this help window the user can access audio, video and text based information, instruction, and help on various DECspin features, indexed by subtopics. The "help" pushbutton icon is a blue circle on a white background having a white "i" in its center, which is the international symbol for "information".

Referring to FIG. **20**, the "call list" window **600** is activated by selecting the "connections" pushbutton **516** (FIG. **18**) of the top level DECspin session window. The "call list" window **600** is a Motif pop-up window which is made up mainly of four columns **602**, **604**, **606** and **608** of Motif widgets. The widgets of the first column **602** include seven "connect" toggle pushbuttons **610***a*–**610***g* each associated with a "network host" field **612***a*–**612***g*, respectively, in the second column **604**. To establish a connection with another workstation, the user enters the target workstation host name and user name into a "network host" field of column **604** and activates the corresponding "connect" toggle pushbutton of column **602** to establish the connection. The syntax for this "host network" field is given as "host:user" for TCP/IP, and as "host::user" for DECnet, respectively. If no user is specified, the DECspin application will attempt to contact anyone logged into the targeted host workstation. The associated "connect" toggle pushbutton of column **602** is activated again to cause disconnection from the target workstation. A "connection" icon **614** located above the "connect" toggle pushbuttons helps to indicate their function to the user.

The widgets of the third and fourth columns **606**, **608** include seven "audio" toggle pushbuttons **616***a*–**616***g* and seven "video" toggle pushbuttons **618***a*–**618***g*, each associated with a "network host" field **612***a*–**612***g*, respectively. The "audio" toggle pushbuttons of **616***a* –**616***g* of column **606** determine if the associated "network host" will receive audio from the workstation, and the "video" toggle pushbuttons **618***a*–**618***g* of column **608** determine if the associated "network host" will receive video from the local workstation. An "audio" icon **620** indicates the function of "audio" toggle pushbuttons **616***a*–**616***g*, and a "video" icon **622** indicates the function of "video" toggle pushbuttons **618***a*–**618***g*. Thus, the user can establish a connection with another multimedia workstation (target host) by simply indicating the target host name in a "network host" field **612** and activating the associated "connect" toggle pushbutton **610**. Once the connection is established, the associated "audio" toggle pushbutton **616** determines if the multimedia workstation will receive audio, and the associated "video" toggle pushbutton **618** determines if the workstation will receive video.

Upon activation of a "connect" pushbutton of column **602**, the DECspin application attempts to call the target host workstation over the network. If a connection cannot be made, a Motif error box (not shown) appears on the local monitor and states what error has occurred. The error box may prompt the user for further instructions, such as retry or cancel.

"Call list" window **600** also includes a "join" pushbutton **624** which, when activated, joins all "network hosts" currently connected to the local workstation into a single video teleconference. This produces an n-way video teleconference between all the network hosts connected to the workstation as indicated by an activated (highlighted) "connect" toggle pushbutton **610***a*–**610***g*.

The "call list" window **600** also allows the user to redirect audio and video to and from a multimedia file. An output file "connect" toggle pushbutton **626** activates a connection to an output file as specified in an associated output file descriptor field **628**. If an output file connection is activated while a teleconference is in progress, a copy of the outgoing transmission from the local workstation is stored to the specified output file. An "audio" toggle pushbutton **630** and a "video" toggle pushbutton **632** associated with the output file descriptor field **628** respectfully determine if audio, video, or both audio and video will be stored to the output file. The audio and video data is stored to the designated output file until the output file "connect" toggle pushbutton is deactivated.

An input file "connect" toggle pushbutton **634** activates playback of an input file containing pre-recorded audio and/or video data, possibly stored earlier by means of the output file "connect" toggle pushbutton discussed above. The input file is specified in an input file descriptor field **636** associated with the input file "connect" toggle pushbutton **634**. Furthermore, if the input file is selected for playback while a video teleconference is in progress, the contents of the file are also sent to the conference members as indicated by the active "connect" toggle pushbuttons **610***a*–**610***g*. In this manner, an audio/video data stream can be sent to and viewed by all conference members simultaneously.

A "filmclip" pushbutton **638** allows a user to view DECspin audio/video messages stored as .SPN files in the conventional system message area, described below. Activation of this pushbutton causes a Motif "file selection box" pop-up window (not shown) to appear which allows the user to select a message file for playback. The message is played back by running the stored audio and video data through a local DECspind application as if the data streams were being sent to the DECspind application by a remote DECspin application.

Finally, the "exit" pushbutton **640** of "call list" **600** terminates the "call list" pop-up window and returns the user

to the active teleconference windows established by means of the "call list" window.

When a call is placed to a target host by activating a "connect" toggle pushbutton a "ring box" pop-up window **800** as shown in FIG. **25** appears on the display of the remote workstation being called. Simultaneously, the keyboard bell of the target host workstation is "rung". A DECspind application window **850**, shown in FIG. **19**, is also displayed on the remote workstation, but with inactive video. The "ring box" window indicates to the user of the target host workstation that a video teleconference call is being attempted with that workstation. The title bar **802** of the "ring box" identifies the calling host workstation and the user who placed the call. No other information (including audio and video) is revealed to the called party unless the call is answered.

The "ring box" **800** offers the called party an "answer" pushbutton **804** and a "busy" pushbutton **806**. If the called party activates the "answer" pushbutton, the target workstation will use a local DECspin application to return audio and video to the calling workstation, and will display the received video in the DECspind application window **850** shown in FIG. **19**. The received audio is audibly reproduced by the DECspind application. This completes the two-way video teleconferencing connection between the calling and the called workstations.

If the called party activates the "busy" pushbutton **806**, the calling party is informed that the called target workstation is busy. Furthermore, the called party can ignore the "ring box". In this case, if there is no answer after a set period of time, e.g., four rings, the calling party is prompted to take further action, such as leave a message or close the call. Still further, the called party can simply "hang up" by activating the "exit" pushbutton **856** of the DECspind application window of FIG. **19**.

If a called party does not answer within a predetermined time period, answers busy, or just hangs up, the calling party is prompted with a Motif information box (not shown) which allows the caller to leave a short audio/video message on the called workstation. This feature works like an answering machine. Alternatively, the caller can be shown a "greetings filmclip" previously stored by the called party which asks the caller to leave an audio/video message on the called workstation.

The maximum length of the message is preset to a reasonable period of time, dependent on the file storage resources of the target system. In one preferred embodiment, the maximum message length is limited to 20 seconds, and is not changeable by the user. The user is presented with a pop-up Motif "countdown" box (not shown) which provides a running indication of the amount of time left while leaving a message.

Messages may be stored in the conventional system message area with, for instance, a .SPN file descriptor extension. Once the caller elects to leave an audio/video message, the DECspin application of the calling workstation directs the audio and video data streams meant for the called workstation to a message "filmstrip" file. Upon invocation of the DECspin application, the system message area is checked for any stored .SPN message files. If any are present, the user is presented with a pop-up Motif "file selection box" window (not shown) which allows the user to select and playback any of the stored messages. The message is played back by running the stored audio and video data streams through a DECspind application as if the data streams were being sent by an active DECspin application. Message files may also be discarded through this pop-up window. Furthermore, the system message area can be checked for .SPN message files at any time by activating the "filmclip" pushbutton **638** of the "call list" window **600**.

Referring to FIG. **21**, the "control" pop-up window **650** is activated by selecting the top level "control" pushbutton **518** (FIG. **18**) of the DECspin session window **510**. The "control" window is a Motif pop-up window which is made up mainly of a column **652** of sliding scale widget controls, and a column of corresponding icons **654** and **656** located on either side of the sliding scale widgets to indicate the function of the associated sliding scale widget. For instance, the top most sliding scale widget **652***a* adjusts the maximum video frame rate for the video teleconference. The video frame rate sliding scale widget includes a control gadget **658***a* which may be moved with the mouse along the length of the sliding scale widget to adjust the maximum frame rate. A digital readout **660***a* above the sliding scale moves with the control gadget and displays the current frame rate setting. The left side icon **654***a* shows a "snail" to indicate movement of the control gadget to the left slows the frame rate. Conversely, the right side icon **656***a* shows a "hare" to indicate movement of the control gadget to the right increases the frame rate.

The remaining sliding scale widgets **652***b*–**652***g* operate in a similar manner to effect their respective controls. Scale **652***b*–**652***g* respectively control color hue (red on left, green on right), color saturation, brightness, contrast, audio volume, and microphone gain. Furthermore, "control" window **650** includes two pushbuttons **660** and **661** for enabling and disabling video compression, respectively. Two other pushbuttons **664** and **666** enable black and white, or color video, respectively. Finally, an "exit" pushbutton **668** terminates the "control" window.

Referring to FIG. **22**, the "monitor" pop-up window **700**, activated by selecting the top level "monitor" pushbutton **520** (FIG. **18**) of the DEcspin application window **510**. The "monitor" window is a Motif pop-up window which includes graphic indicators for displaying certain video teleconferencing parameters and statistics. The displayed statistics are updated periodically, for instance, every five seconds.

Information related to the video image generated by the DECspin application is displayed below a "camera" icon **702**. The video image information includes a digital readout **704** of the video image size in horizontal by vertical pixels, and a sliding scale indicator **706** with an associated digital readout **708** for showing the average frame rate. These two parameters are important since the DECspin video window **524** of FIG. **18** may be "sized", as discussed above, to change the number of pixels contained in the image. Changing the number of pixels also effects the video frame rate. Both these video parameters can be monitored by these indicators as the DECspin window is sized.

Information related to the network and active video teleconference is displayed by indicators located below a "connection" icon **710**. This information includes digital readouts of the total number of active teleconferencing connections **712**, the number of active audio connections **714**, and number of active video connections **716**. Finally, a sliding indicator **718** and an associated digital readout **720** display the average network consumption. An "exit" pushbutton **722** terminates the "monitor" pop-up window.

Referring to FIG. **23**, the "information" pop-up window **750** is activated by selecting the "help" pushbutton **522** (FIG. **18**) of the top level DECspin session window **510** and allows the user access to textual and "filmclip" documentation for the DECspin application. The "information" win-

dow is a second level Motif pop-up window which is made up of a column **752** of user selectable pushbuttons configured as a Motif Radio Box so that only a single pushbutton can be activated at one time. Each pushbutton is labeled with a sub-topic for which help documentation is available. For instance, in the embodiment of FIG. **23**, help documentation is available to provide an overview of the video teleconferencing system **754**, to help start a conference **756**, to help with a specific video teleconferencing feature **758**, or to help troubleshoot a video teleconferencing problem **760**. Upon activation of one of the topic pushbuttons, a third level "sub-help" window **780** of FIG. **24** appears offering the user a further breakdown of subjects related to the selected topic. For instance, the "sub-help" window of FIG. **24** shows the subjects available to the user after selecting the overview pushbutton **754** of FIG. **23**.

The "sub-help" window **780** of FIG. **24** is a third level Motif pop-up window having a column of pushbuttons **782** and **784** on each side of a center column **786** of subject labels. The left column of pushbuttons **782** activates a bookreader textual documentation system for the corresponding subject. For instance, activation of pushbutton **788** will present the user with text on the workstation display describing an introduction to the video teleconferencing system. The right column of pushbuttons **784** activates a "filmclip" for the corresponding subject. For instance, activation of pushbutton **790** will open another DECspind window on the display through which a "filmclip" demonstration will be played back to the user.

The help system thus described offers the user three levels of comprehensive textual, audio and visual system documentation. At the first level, the "talking keys" offer the user quick access to audio information about a function available for selection by the user. At the second level, the pop-up "information" window helps to narrow the user's help requirements to a specific topic. At the third level, the pop-up "sub-help" window offers the user textual and/or audio/visual documentation on a variety of subjects related to the selected second level topic.

Furthermore, the file storage structure for the help documentation adds a high degree of flexibility to the audio/visual documentation system of this invention. For instance, each "audio clip" of the "talking key" help function is stored in a separate key-specific file which is played back when the talking help function is activated. Thus, if the function of a key changes, only a single audio file needs to be updated. Furthermore, the audio help system can be easily internationalized by providing an "audio clip" file set corresponding to the desired foreign language. This also applied to the textual and "filmclip" documentation which is stored in separate subject-specific files. Thus, if a system function changes, only the text and/or "filmclip" files affected by the change need to be updated. Although this audio/visual documentation system has been described with reference to the video teleconferencing application of this invention, it will be apparent to those skilled in the art that such an audio and/or visual help system can be provided on a multi-media workstation or PC for virtually any type of application.

FIGS. **26**(*a*)–**26**(*k*) show the display screens of three workstations, Workstation A (**30***a*), Workstation B (**30***b*), and Workstation C (**30***c*) during the initiation of a typical three-way video teleconference using the Graphical User Interface of this invention. FIG. **26**(*a*) shows a typical display **30***a* for Workstation A after the DECspin application has been invoked but before the initiation of a video teleconference. This display shows a DECspin session window **510***a* for monitoring the local video generated by Workstation A. The user of Workstation A has activated the "call list" window **600***a*, the "control" window **650***a*, and the "monitor" window **700***a*.

The user of Workstation A initiates a video teleconference call to Workstation B ("host B") by activating pushbutton **610***a* of the "call list" window. FIG. **26**(*b*) shows the display **30***b* of Workstation B after Workstation A places the call. A "ring box" **800***a* and a blank DECspind session window **850***a*, identifying the calling party ("host A") appear on the Workstation B display. The user of Workstation B answers the video teleconference call by activating the answer pushbutton of "ring box" **800***a*.

FIG. **26**(*c*) shows the display **30***b* of Workstation B after the user answers the call from Workstation A. Here, the video (and audio) of the host A DECspind session window **850***a* has been activated. Further, a local DECspin session window **510***b* appears to allow the user of Workstation B to monitor the local video signal. Here also, the user of Workstation B has invoked the "control" window **650***b* from the DECspin session Window **510***b*. FIG. **26**(*d*) shows the display of Workstation A after Workstation B has answered the video teleconference call. A host B DECspind window **850***b* provides return video from Workstation B to Workstation A.

The user of Workstation A initiates a video teleconference call to another user on Workstation C ("host C") by activating pushbutton **610***b* of the "call list" window **600***a*.

FIGS. **26**(*e*) and **26**(*f*) show the display **30***c* of Workstation C after Workstation A places the call, and after Workstation C answers the call, respectively. Here again, the user answering the call to Workstation C causes the invocation of a local DECspin session window **510***c* to monitor local video from Workstation C. FIG. **26**(*g*) shows the display **30***a* of Workstation A after the user of Workstation C answers the call. A host C DECspind session widow **850***c* displays the return video from Workstation C to Workstation A.

At this point the user of Workstation A can join the users of Workstation B and Workstation C into a three-way conference by activating the "join" pushbutton **624** of the "call list" window **600***a*. Upon activation of the "join" pushbutton, Workstation B is caused to place a video teleconference call to Workstation C, and vice versa. FIGS. **26**(*h*) and **26**(*i*) show the display of Workstation B and Workstation C, respectively, after the call is placed, but before it is answered. A "ring box" and blank DECspind application session window from Workstation C (**800***c* and **850***c*) appear on the display of Workstation B (FIG. **26**(*h*)) and a "ring box" and blank DECspind application session window from Workstation B (**800***b* and **850***b*) appear on the display of Workstation C (FIG. **26**(*i*)).

FIGS. **26**(*j*) and **26**(*k*) show the display of Workstation B and Workstation C, respectively, after the user of each workstation has answered their respective "ring box" of FIGS. **26**(*a*) and **26**(*i*). Thus, FIGS. **26**(*g*), **26**(*j*) and **26**(*k*) show the resulting display of Workstations A, B, and C, respectively, when all are joined into a three-way video teleconference.

Pixel Decimation and Replication

FIG. **27** shows a flowchart of a process for implementing the Pixel Decimation and Replication (PDR) video compression technique of this invention. This technique is especially attractive as an inexpensive alternative to video compression techniques, such as JPEG or MPEG, which typically require dedicated hardware support.

Specifically, the frame grabber **34** (FIG. **2**) Captures **550** a video frame in the video buffer **35** (FIG. **2**), and proceeds to scale **552** by ½ the video data in the horizontal and

vertical directions. In the preferred embodiment, the scaling is accomplished by a mechanism internal to the particular video grabber in response to a "scale" command. However, generally, the scaling can be accomplished by producing a "scaled" pixel based on the contents of the pixels it replaces, e.g., by implementing a pixel averaging function.

In its simplest form, the scaling can be accomplished by discarding every other pixel along a horizontal line, and every other entire horizontal line. FIG. **28**(*a*) show a pictorial representation of a video frame **580** measuring **480** vertical (V) pixels by **680** horizontal (H) pixels. An "X" in the pixel indicates that it is eliminated from the video frame. The resulting scaled video frame **582** is shown in FIG. **28**(*b*) and has **240** vertical pixels by **320** horizontal pixels, or ¼ the quantity of original pixels.

The resulting scaled video frame **582** is then made available to the DECspin application for transmission **554** across the network to a remote workstation. The remote workstation receives **556** the scaled video frame with a DECspind application. The DEcspind application proceeds to reconstruct a **480** by **640** pixel video frame **584** as shown in FIG. **28**(*c*) from the received scaled video frame. First the DECspind application replicates each scaled pixel along a horizontal line to produce **640** pixels along a line. For instance, the (**1**,**1**) pixel of the original unscaled video frame **580** of FIG. **28**(*a*), where the notation is given as (V,H), is relocated to the (**1**,**1**) position and replicated to the (**1**,**2**) position of the reconstructed video frame **584** of FIG. **28**(*c*). Similarly, the (**1**,**3**) pixel of the original frame **580** is relocated to the (**1**,**3**) position and replicated to the (**1**,**4**) position of the reconstructed frame **584**.

Next, when an entire line of pixels has been reconstructed, that line is replicated **560**, shifted **562** by one pixel and stored as the next adjacent vertical line in the reconstructed video frame. For example, as shown in FIG. **28**(*c*), the reconstructed pixels from the first horizontal line (V=1) are replicated to the second horizontal line (V=2) and shifted by 1 pixel to the right. Thus, for example pixel (**1**,**1**) of the original video frame **580** is replicated into positions (**2**,**2**) and (**2**,**3**) of the reconstructed video frame **584**, and pixel (**1**,**3**) of the original video frame **580** is replicated into positions (**2**,**4**) and (**2**,**5**) of the reconstructed video frame **584**. It should be noted that the pixel on the left end of a replicated line (V=2) can be left blank (black), filled with a pre-determined color or grey level, or filled with yet another replication of the next adjacent pixel. On the other hand, the last pixel on a replicated line will only be reproduced once. These results will be reversed if the replicated line is shifted to the left by one pixel, rather than to the right as assumed in the above example.

Finally, the pixel and line replication process is repeated **566** for each line of scaled video data received by the DECspind application. When the DECspind application is done **564** reconstructing the entire scaled video frame, the reconstructed frame is made available for display **568** by the DECspind application. It should be noted that an analogous reconstruction technique that replicates pixels along a vertical column as just described for pixels along a horizontal line, and replicates and shifts vertical pixel columns as just described for horizontal lines, produces similar results. The DECspind application displays the reconstructed video frame in a DECspind application window synchronized to the audio data stream in a manner described above.

Equivalents

While this invention has been particularly shown and described with references to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims. For example, although the audio/video "filmclip" storage and retrieval features of this invention have been described with reference to a video teleconferencing application, these "filmclip" features are not limited to video teleconferencing applications. Rather, these features can be used generally for storage and retrieval of audio and/or video on a multimedia workstation or personal computer system.

What is claimed is:

1. A method for storing and retrieving audio and video data on a multimedia workstation, comprising the steps of

a) storing an audio data stream from a workstation to a data file accessible by the workstation such that the audio data stream can be retrieved from the data file and reconstructed by the workstation into a continuous audio signal;

b) storing a non-continuous logical stream of video data from the workstation to the data file such that each frame of video data stored to the data file is inserted into the audio data stream also stored in the data file by the workstation without affecting the continuity of the audio signal when later retrieved from the data file and reconstructed by the workstation, said noncontinuous logical stream of video data being available video data remaining after portions of an initial video data stream have been discarded, while the audio data stream as stored in the data file remains unbroken; and

c) attaching timing information to each frame of video data stored to the data file indicating a point in the audio data stream also stored to the data file which corresponds in time to the frame of video data, such that the stored available video data in the form of a noncontinuous logical stream of video data is realigned with the stored unbroken audio data stream.

2. A method for storing and retrieving audio and video data as described in claim **1** wherein the non-continuous video data results from network congestion.

3. The method of claim **1** further comprising the step of displaying a frame of video data, retrieved from the data file, on the display of the workstation when the point in the audio data stream, retrieved from the data file, corresponding to the timing information of the retrieved video frame is audibly reproduced by the workstation.

4. The method of claim **3** further comprising the steps of

a) the workstation internally generating timing information by counting the amount of audio data in the audio stream retrieved from the data file; and

b) the workstation comparing the internally generated timing information with the timing information stored in the data file corresponding to the frame of video data most recently retrieved from the data file to determine when to display the most recently retrieved frame of video data on the display of the workstation.

5. A multimedia workstation, comprising:

a) storage means for a workstation to store a stream of audio data packages and a corresponding noncontinuous logical stream of video data as digital data packets to a data file accessible by the workstation as audio and video data packets, the video packets including timing information such that the stored available video data in the form of a noncontinuous logical stream of video data can be realigned with a stored unbroken audio data stream, said noncontinuous logical

stream of video data being available video data remaining after portions of an initial video data stream have been discarded, while the audio data stream as stored in the data file remains unbroken; and

b) retrieval means for the workstation to retrieve audio and video data from the data file which was stored as digital data packets by the storage means.

6. A multimedia workstation as described in claim 5 wherein the non-continuous video data results from network congestion.

7. The multimedia workstation of claim 5, wherein

the retrieval means retrieves the data packets from the data file and reconstructs the audio and video data stored by the storage process for audible and visual reproduction, respectively.

8. The multimedia workstation of claim 7 wherein

a) the storage means further comprises means for attaching timing information to each frame of video data stored to the data file indicating a point in the audio data stream also stored to the data file which corresponds in time to the frame of video data; and

b) the retrieval means further comprises synchronization means for displaying a frame of video data, retrieved from the data file, on the display of the workstation when the point in the audio data stream, retrieved from the data file, corresponding to the timing information of the retrieved video frame is audibly reproduced by the workstation.

9. The multimedia workstation of claim 8 wherein

a) the retrieval means further comprises timing means for generating timing information by counting the amount of audio data in the audio stream retrieved from the data file; and

b) the synchronization means further comprises comparison means for comparing the internally generated timing information with the timing information stored in the data file corresponding to the frame of video data most recently retrieved from the data file to determine when to display the most recently retrieved frame of video data on the display of the workstation.

10. The multimedia workstation of claim 5 wherein the data file is accessed using a TCP/IP protocol data socket.

11. A multimedia computer workstation, comprising

a video source that provides sequential frames of digitized video data;

an audio source that provides a digitized audio data stream that represents a continuous audio signal synchronized to the sequential frames of digitized video data;

data storage capable of storing a non-continuous logical stream of video data with a corresponding stream of audio data to a data file such that each frame of video data stored to the data file is sequentially inserted into the audio data stream without affecting the continuity of the audio signal represented by the audio data stream, said noncontinuous logical stream of video data being available video data remaining after portions of an initial video data stream have been discarded, while the audio data stream as stored in the data file remains unbroken;

means for audibly reproducing retrieved audio data stream into a continuous audio signal; and

a display that displays retrieved sequential frames of video data on the display of the workstation synchronized to the reproduced audio signal such that the stored available video data in the form of a noncontinuous logical stream of video data is realigned with the stored unbroken audio data stream.

12. The multimedia workstation of claim 11, wherein the video source comprises a video camera providing sequential frames of live analog video, and frame capture device for capturing, digitizing, and storing each sequential frame of live analog video.

13. The multimedia workstation of claim 11, wherein the video source comprises means for providing pre-recorded sequential frames of analog video, and frame capture means for capturing, digitizing, and storing each sequential frame of pre-recorded analog video.

14. The multimedia workstation of claim 13, wherein the video source comprises a video tape recorder.

15. The multimedia workstation of claim 13, wherein the video source comprises a video laser disk player.

16. The multimedia workstation of claim 11 wherein the audio source comprises a microphone for transducing live audio into an analog audio signal, and audio digitizer and storage for digitizing and storing the analog signal.

17. The multimedia workstation of claim 16 wherein the audio digitizer and storage applies mu-law compression in digitizing the analog audio signal.

18. The multimedia workstation of claim 11 wherein the audio source comprises means for providing pre-recorded audio signals corresponding to sequential frames of pre-recorded video.

19. The multimedia workstation of claim 11 wherein the data file is accessed using a TCP/IP protocol data socket.

20. The multimedia workstation of claim 11 wherein the storage comprises video compressor for reducing the quantity of data required to be stored to the data file to represent each frame of video data.

21. The multimedia workstation of claim 20 wherein the video compressor applies JPEG compression to the video data.

22. The multimedia workstation of claim 20 wherein the video compressor applies MPEG compression to the video data.

23. The multimedia workstation of claim 11 wherein the workstation comprises an IBM compatible personal computer.

24. The multimedia workstation of claim 11 wherein the workstation comprises a RISC processor.

25. A multimedia computer workstation as described in claim 11 wherein the non-continuous video data results from network congestion.

26. A method of processing audio/video data information, the method comprising the steps of:

capturing time-related audio and video data for transmission over a logical connection between two workstations coupled to a network;

at a transmitting workstation, digitizing the audio and video data into packets for transmission over a logical connection to a target workstation;

transmitting timing information to the target workstation for reconstructing the time-related audio and video data transmitted over the logical connection; and

monitoring a throughput capacity of the network and discontinuing transmission of a logical stream of the video data during periods of congestion, yet continuing to transmit a sensibly continuous logical stream of audio data for reconstruction at the target workstation, said timing information enabling realignment of available transmitted video data with the transmitted continuous audio data.

27. A method as in claim 26, wherein each of the workstations is capable of sonically reproducing the audio data and visually reproducing video data received from another workstation.

28. A method as in claim 26, wherein the transmitting workstation discontinues transmission of video data if a digitized block of video information is not transmitted over the network within a specified timeout period.

29. A method as in claim 26, wherein the audio and video data is initially encoded based on an NTSC (National Television System Committee) standard that is converted to digital data packets for transmission over the network.

30. A method as in claim 26, wherein the audio and video data is transmitted to a target workstation based on a TCP/IP protocol.

31. A method as in claim 26 further comprising the step of:

receiving the audio and video data at the target workstation and reconstructing an originally captured image and sound for a user.

32. A method as in claim 26, wherein the audio and video data sent across the network includes frames of video information inserted into a sensibly continuous stream of audio data.

33. A method as in claim 26, wherein the target workstation plays the sensibly continuous audio stream and time-related corresponding received frames of video data.

34. A method as in claim 26, wherein the video data is video frame information digitized into data packets comprising less than 32 kilobits of data.

35. A method as in claim 26 further comprising the steps of:

discarding video data when network congestion is detected so that newer video data can be transmitted to the target workstation.

36. A method as in claim 35 further comprising the steps of:

at the target workstation, synchronizing a playback of received audio data with received video data regardless of whether video data is discarded.

37. A method as in claim 26 further comprising:

storing the audio and video data in memory.

38. A method as in claim 26, wherein a transmission of audio and video data over a logical connection of the network supports a teleconference session.

39. A method as in claim 26 further comprising:

continuing transmission of a logical steam of video data when a logical connection supports appropriate throughput.

40. A method as in claim 39, wherein the video data is current video data.

* * * * *

RELATED PROCEEDINGS APPENDIX: None